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: Computer Science Stream **Duration: 3 hrs.**
Course Code: 22PH1BSPCS / 22PH2BSPCS **Max Marks: 100**
Course: Applied Physics for Computer Science 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.

			CO	PO	Marks
		MODULE - I			
1	a)	Derive an expression for the energy density of radiation at thermal equilibrium in terms of Einstein's coefficients.	CO1	PO1	08
	b)	What is numerical aperture? Derive an expression for the numerical aperture of an optical fiber.	CO1	PO1	08
	c)	The angle of acceptance of an optical fiber is 30^O when kept in air. Find the angle of acceptance of an optical fiber when placed in the medium of refractive index 1.33.	CO1	PO2	04
		OR			
2	a)	Discuss two general condition for LASER action. Explain the working of LASER barcode reader.	CO1	PO1	08
	b)	Discuss with a block diagram point-to-point optical fiber communication system. Mention the advantages of optical fiber communication system over other conventional communication system.	CO1	PO1	08
	c)	The average output power of a Laser beam of wavelength 700 nm is 12 mW. Find the number of photons emitted per second by the Laser source.	CO1	PO2	04
		MODULE - II			
3	a)	Define phase velocity and group velocity and obtain the relation between them in terms of wavelength.	CO1	PO1	08
	b)	Apply Schrodinger's wave equation to a particle confined to one dimensional potential well of infinite height and hence obtain the expressions for eigen values and eigen functions.	CO1	PO1	08

		c)	A particle of mass 0.5 MeV/c^2 has a kinetic energy of 120 eV. Find its de-Broglie wavelength and group velocity, where c is the velocity of light.	***CO1***	***PO2***	**04**
			OR			
	4	a)	Set up a time-independent Schrodinger's wave equation for a particle moving along X direction.	***CO1***	***PO1***	**08**
		b)	State Heisenberg's uncertainty principle and explain why the electron does not exist inside the nucleus using this principle.	***CO1***	***PO1***	**08**
		c)	An electron is bound in a one-dimensional potential well of width 0.5 A^0, but of infinite wall height. Find its energy values in the ground state and also in the first two excited states.	***CO1***	***PO2***	**04**
			MODULE - III			
	5	a)	What are the assumptions of quantum free electron theory? Explain any two merits of quantum free electron theory.	***CO1***	***PO1***	**08**
		b)	What is polarization in dielectrics? Describe the different polarization mechanisms with neat schematic diagrams.	***CO1***	***PO1***	**08**
		c)	Calculate the probability of an electron occupying an energy level 0.02eV above the Fermi level at 200 K and 400 K in a material.	***CO1***	***PO2***	**04**
			MODULE - IV			
	6	a)	What is Hall effect? Obtain an expression for Hall voltage in terms of Hall coefficient of a semiconductor.	***CO1***	***PO1***	**08**
		b)	What is Meissner effect? Classify superconductors into soft and hard superconductors by using M-H graphs.	***CO1***	***PO1***	**08**
		c)	For intrinsic Gallium arsenide, at room temperature electrical conductivity is10^{-6} /Ωm. The electron and hole mobilities are 0.85 $m^2v^{-1}s^{-1}$ and 0.04 $m^2v^{-1}s^{-1}$, respectively. Compare the intrinsic carrier concentration at room temperature.	***CO1***	***PO2***	**04**
			MODULE - V			
	7	a)	State Pauli's matrices and apply Pauli matrices on the states $\|0\rangle$ and $\|1\rangle$.	***CO1***	***PO1***	**08**
		b)	Describe the working of CNOT Gate and T gate, mentioning its matrix representation, circuit and truth table.	***CO1***	***PO1***	**08**
		c)	Show that Hadamard gate is Unitary.	***CO1***	***PO2***	**04**

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