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: 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, $m_e = 9.1 \times 10^{-31}$ 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

		MODULE - I	CO	PO	Marks
1	a)	Explain the construction and working of semiconductor laser with energy level diagram.	CO1	PO1	**8**
	b)	What is fiber loss? Explain the factors contributing for fiber loss.	CO1	PO1	**8**
	c)	Light gathering capacity of an optical fiber is 0.479. If fractional index change is 0.005, calculate the refractive index of cladding.	CO1	PO2	**4**
		OR			
2	a)	Derive an expression for energy density of radiation in terms of Einstein's A & B coefficients.	CO1	PO1	**8**
	b)	Discuss point-to-point optical fiber communication. Also, mention its four advantages over the conventional communication system.	CO1	PO1	**8**
	c)	The average power of the laser source is 5mW and the wavelength of the laser beam is 632nm. Find the number of photons emitted per second by the laser source.	CO1	PO2	**4**
		MODULE - II			
3	a)	Establish the energy quantization for a particle confined inside an infinitely deep potential well of finite width by applying Schrodinger equation.	CO1	PO1	**8**
	b)	Define the terms group velocity and phase velocity. Obtain the relation between them in terms of wavelength.	CO1	PO1	**8**

		c)	The position and momentum of an electron with energy 0.5 keV are determined. What is the minimum percentage of uncertainty in its momentum, if the uncertainty in the measurement of its position is 0.5 Å .	*CO1*	*PO2*	**4**
			OR			
	4	a)	What is wave function? Set up one dimensional time independent Schrodinger wave equation for a particle moving along x-axis.	*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)	Calculate the de-Broglie wavelength associated with an electron having kinetic energy of 100 eV.	*CO1*	*PO2*	**4**
			MODULE - III			
	5	a)	Explain electronic polarization. Derive an expression for electronic polarizability in dielectrics.	*CO1*	*PO1*	**8**
		b)	List the assumptions of quantum free electron theory. Explain any two of its merits.	*CO1*	*PO1*	**8**
		c)	Find the temperature at which there is 1% probability that a state with energy 0.5eV above Fermi energy is occupied.	*CO1*	*PO2*	**4**
			MODULE - IV			
	6	a)	Explain Hall effect in a semiconductor. Obtain an expression for Hall voltage in terms of Hall co-efficient.	*CO1*	*PO1*	**8**
		b)	What are superconductors? With neat schematic cross sectional view, explain the application of superconductivity in MAGLEV vehicle.	*CO1*	*PO1*	**8**
		c)	A superconducting material has a critical temperature of 3.7K in zero magnetic field and a critical field of 0.0306 Tesla at 0K. Find critical field at 2 K.	*CO1*	*PO2*	**4**
			MODULE - V			
	7	a)	Explain quantum superposition. Mention the differences between classical and quantum computing.	*CO1*	*PO1*	**8**
		b)	What are Pauli's matrices? Discuss the operation of Pauli's matrices on quantum states |0> and |1>.	*CO1*	*PO1*	**8**
		c)	If the quantum mechanical system $\varphi = \begin{bmatrix} 2i \\ 3+4i \end{bmatrix}$ $\psi = \begin{bmatrix} 3+4i \\ 2i \end{bmatrix}$ then find $\langle\psi\|\varphi\rangle$.	*CO1*	*PO2*	**4**

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