U.S.N.										

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

Autonomous Institute Affiliated to VTU

September / October 2024 Supplementary Examinations

Programme: B.E. **Semester: I / II**
Branch: Common to all Branches **Duration: 3 hrs.**
Course Code: 21PY1BSPHY / 21PY2BSPHY **Max Marks: 100**
Course: ENGINEERING PHYSICS

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

Planck's constant, $h = 6.63 \times 10^{-34}$ Js
Boltzmann constant, $k = 1.38 \times 10^{-23}$ J/K
Mass of electron, $m_e = 9.11 \times 10^{-31}$ kg
Velocity of light, $c = 3 \times 10^{8}$ m/s
Mass of neutron, $m_n = 1.675 \times 10^{-27}$ kg
Avogadro's number, $N_A = 6.02 \times 10^{26}$ /k mol
Charge of electron, $e = 1.602 \times 10^{-19}$ C
Permittivity of vacuum, $\epsilon_o = 8.85 \times 10^{-12}$ F/m

Module - I

1	a)	Define phase velocity and group velocity. Obtain the relation between the group velocity and particle velocity.	**8**
	b)	Apply Schrodinger's wave equation to a particle confined in a one dimensional potential well of infinite height to obtain normalized eigen functions.	**8**
	c)	Calculate the kinetic energy and group velocity of an electron having a de-Broglie wavelength of 2 nm.	**4**

OR

2	a)	State and explain Heisenberg's uncertainty principle. Using this principle show that a free electron cannot exist within the nucleus of an atom.	**8**
	b)	Mention the properties of the wave function. Set up time-independent one-dimensional Schrodinger's wave equation.	**8**
	c)	An electron has a speed of 800 ms^{-1} with an accuracy of 0.004%. Calculate the certainty with which we can locate the position of the electron.	**4**

Module - II

3	a)	Derive an expression for the energy density of radiation under equilibrium conditions in terms of Einstein's coefficients.	**8**
	b)	Discuss the construction and working of semiconductor diode LASER with an energy level diagram.	**8**
	c)	The ratio of population of two energy levels is 1.059×10^{-30}. Find the wavelength of light emitted at 330 K.	**4**

OR

4	a)	What is numerical aperture? Derive an expression for the numerical aperture of an optical fiber and then arrive at the condition for light propagation.	**8**

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.

	b)	With suitable block diagram explain the point-point optical fiber communication. Mention any two advantages of optical fiber communication over conventional communication system.	**8**
	c)	The number of modes in a step index fiber is 3500. The diameter of the core is 50 μm and numerical aperture is 0.25. Calculate the operating wavelength.	**4**

Module - III

5	a)	Define Fermi energy and Fermi factor. Discuss the dependance of Fermi factor on energy and temperature with suitable drawing.	**8**
	b)	Define coefficient of thermal conductivity of a metal and mention its SI unit. Obtain the expression for thermal conductivity of a conductor using classical free electron theory.	**8**
	c)	Calculate the probability of an electron occupying an energy level 0.02 eV above and below the Fermi level at 200 K.	**4**

Module - IV

6	a)	What is the internal field? Derive an expression for internal field in solid and liquid dielectrics for one dimensional array of atoms.	**8**
	b)	With suitable diagram explain the phenomenon of Hall Effect in semiconductors. Obtain the expression for Hall voltage and Hall coefficient.	**8**
	c)	A solid contains $5x10^{28}$ identical atoms per m^3, each with a polarizability of $2x10^{-40}$ Fm^2. Assuming that the internal field is given by the Lorentz relation, calculate the ratio of the internal field to the applied field.	**4**

Module - V

7	a)	What is simple harmonic motion. Derive the differential equation for SHM and arrive at an expression for time period and frequency.	**8**
	b)	What are forced vibrations? Set up the equation of motion for forced vibration and obtain the expression for maximum amplitude.	**8**
	c)	A particle executes SHM of amplitude 5 cm. When the particle is 3 cm away from the mean position its acceleration is found to be 48 cm s^{-2}. Calculate its velocity at the same instant and its time period.	**4**

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