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: 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. **Constants:** Planck's constant, $h = 6.63 \times 10^{-34}$ Js,
Mass of electron, $m_e = 9.11 \times 10^{-31}$ kg,
Charge of electron, $e = 1.602 \times 10^{-19}$ C,
Boltzmann constant, $k = 1.38 \times 10^{-23}$ J/K,
Avogadro's number, $N_A = 6.02 \times 10^{26}$ /k mol
Velocity of light, $c = 3 \times 10^8$ m/s
Permittivity of free space, $\varepsilon_0 = 8.854 \times 10^{-12}$ F/m

MODULE - I

1.	a)	Define the term group velocity & phase velocity. Arrive at the relation between group velocity & phase velocity in terms of wavelength.	**08**
	b)	Derive an expression for one dimensional time independent Schrodinger wave equation.	**08**
	c)	An electron has a de Broglie wavelength of 1.5 nm. Find its kinetic energy and group velocity.	**04**

OR

2.	a)	What are de-Broglie waves? Derive an expression for de-Broglie wavelength using the concept of group velocity.	**08**
	b)	Obtain an expression for normalized wave function for a particle in one dimensional potential well of infinite height.	**08**
	c)	Calculate the energy required for an electron to jump from ground state to first excited state in a box of width 1.5Å.	**04**

MODULE - II

3.	a)	Obtain an expression for energy density of a system under thermal equilibrium in terms of Einstein's coefficients.	**08**
	b)	Define numerical aperture of an optical fiber and derive an expression for numerical aperture with a neat ray diagram.	**08**
	c)	Certain LASER system gives out 3×10^7 photons for a pulse when operated with a power of 1 mW for 11 ns. Calculate the wavelength of LASER.	**04**

OR

4. a) Describe the construction and working of semiconductor LASER with a neat diagram. **08**

b) Define attenuation co-efficient. Mention its unit. Derive an expression for attenuation coefficient in an optical fiber. **08**

c) The numerical aperture of an optical fiber is 0.39. If the difference in the refractive indices of the material of its core & the cladding is 0.05, calculate the refractive index of the material of the core. **04**

MODULE - III

5. a) Define Fermi energy & Fermi factor. Discuss the variation of Fermi factor with temperature using a suitable graph. **08**

b) Explain with suitable diagram the theory of determining coefficient of thermal conductivity of a poor conductor by Lee-Charlton's method. **08**

c) Evaluate the Fermi function for an energy (kT/2) below the Fermi level, where the symbols have their usual meaning. **04**

MODULE - IV

6. a) Derive an expression for internal field in one dimensional array of atoms of liquid or solid dielectrics. **08**

b) Explain Hall effect in semiconductors with neat diagram. Derive an expression for Hall voltage. **08**

c) For intrinsic gallium arsenide, the room temperature electrical resistivity is 1.1×10^7 Ω-m. If the electron and hole mobilities are respectively 0.75 m^2/Vs and 0.03 m^2/Vs, compute the intrinsic carrier concentration at room temperature. **04**

MODULE - V

7. a) What is Forced vibration? Deduce an expression for amplitude of a body executing forced vibration. **08**

b) Explain (i) logarithmic decrement (ii) Relaxation time and (iii) Quality factor in case of damped oscillator. **08**

c) An object of mass 4 kg is attached to the bottom of a spring and set vibrating. If the time period of the object is 600 ms, calculate (i) the force constant & (ii) the frequency of oscillation. **04**

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