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: Common to all Branches **Duration: 3 hrs.**
Course Code: 21PY1BSPHY / 21PY2BSPHY **Max Marks: 100**
Course: Engineering Physics

Instructions: Answer any FIVE full questions, choosing one full question from each unit.

Physical constants:

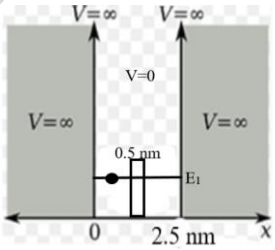
Planck's constant, $h=6.627\times10^{-34}$ J-s
Electronic charge, $e=1.602\times10^{-19}$ C
Mass of electron, $m_e=9.1\times10^{-31}$ kg
Mass of proton/neutron, $m_p= m_n=1.67\times10^{-27}$ kg
Speed of light, $c=3\times10^{8}$ m/s
Avogadro number, $A=6.023\times10^{26}$ kg/mol
Boltzmann's constant, $k=1.38\times10^{-23}$ J/K
Permittivity of free space $\epsilon_o=8.85\times10^{-12}$ F/m

UNIT - I

1 a) Define group velocity. Deduce its relationship with particle velocity. **8**

b) State Heisenberg's Uncertainty principle. Using this principle show that an electron cannot reside inside the nucleus of an atom. **8**

c) **4**



A moving particle is confined in one dimensional potential well of width 2.5 nm as shown in the above figure. Calculate the probability of finding it in the ground state, at the center of the well, in an interval of 0.5 nm.

OR

2 a) Explain the properties of wave function. Set up the Schrodinger's one dimensional time independent equation for a quantum particle. **8**

b) Explain de-Broglie's hypothesis. Derive an expression for de-Broglie wavelength of matter-wave starting from the expression for group velocity. **8**

c) Calculate the uncertainty in the velocities of (i) an electron and (ii) a proton confined inside a potential well of width 1 nm. **4**

UNIT 2

3 a) Describe the construction of semiconductor diode LASER with a schematic representation and its working with an energy level diagram. **8**

b) Derive an expression for attenuation coefficient and mention various types of attenuation mechanism in optical fibers. **8**

c) Find the wavelength of LASER light emitted at 57°C when the ratio of population of energy levels between which electron transition takes place is 1.059×10^{-30}. **4**

OR

4 a) Starting from the three transition rate equations, arrive at the relationship between Einstein's coefficients, at thermal equilibrium. **8**

b) Explain with a block diagram, how the transmission and reception of information takes place through an optical fiber. **8**

c) Calculate the angle of acceptance of an optical fiber, when the launching end is in water with refractive index 1.33, given that the acceptance angle of the fiber in air is 30 °. **4**

UNIT 3

5 a) Describe any three parameters which quantum free electron theory successfully explains. **8**

b) Explain the theory to determine the thermal conductivity of a bad conductor with a neat diagram. **8**

c) Calculate the probability of an electron occupying an energy level 0.02 eV above the Fermi level at 400 K and 200 K in a material. **4**

UNIT 4

6 a) Explain the various types of polarization mechanisms in dielectrics. **8**

b) Derive an expression for the concentration of electrons in the conduction band of a semiconductor. **8**

c) The conductivity and the Hall coefficient of an n-type silicon specimen are 112/Ωm and $1.25 \times 10^{-3} m^3/C$, respectively. Calculate the charge carrier concentration and electron mobility. **4**

UNIT 5

7 a) Set up equation of motion for forced vibration and obtain an expression for its amplitude. **8**

b) Show that the sum of kinetic energy & potential energy for particle executing simple harmonic motion is constant. **8**

c) The Q-factor of a spring loaded with 0.3 kg is 60. It vibrates with a frequency of 2 Hz. Calculate the force constant and mechanical resistance. **4**

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