CBCS SCHEME

USN | | | | | | | | | | 17PHY12/22

First/Second Semester B.E. Degree Examination, Dec.2018/Jan.2019
Engineering Physics

Time: 3 hrs. Max. Marks: 100

Note: *1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. Physical constants; Velocity of light, $c = 3 \times 10^8$ m/s mass of the electron, $m = 9.1 \times 10^{-31}$ kg Planck's constant, $h = 6.625 \times 10^{-34}$ JS charge of electron, $e = 1.6 \times 10^{-19}$C Boltzmann's constant $K = 1.382 \times 10^{-23}$J/K Avagadro's number, $N_A = 6.02 \times 10^{26}$/K mole.

Module-1

1 a. Define group velocity and phase velocity and hence obtain the relation between them. **(06 Marks)**

b. Mention any four important characteristics of matter waves. **(04 Marks)**

c. Assuming time independent Schrodinger wave equation, obtain an expressions for energy eigen value and eigen function for an electron in one dimensional potential well of infinite wall height. **(07 Marks)**

d. The velocity of uncertainty electron was observed to be 5×10^3 m/s. Using Heisenberg uncertainty principle. Calculate the uncertainty of an electron in its position. **(03 Marks)**

OR

2 a. Mention assumption of Planck's law. Obtain Wien's law and Rayleigh-Jean's law from Planck's law for shorter and longer wavelength limits. **(07 Marks)**

b. Set up time independent one dimensional Schrodinger wave equation. **(07 Marks)**

c. Briefly explain probability density of wave function. **(03 Marks)**

d. An electron has K.E. 120 eV. Find its de Broglie wavelength. **(03 Marks)**

Module-2

3 a. Discuss the merits of quantum free electron theory. **(06 Marks)**

b. Derive an expression for electrical conductivity of an intrinsic semiconductor. **(05 Marks)**

c. What is Meissner effect? Explain Type-I and Type-II superconductors. **(05 Marks)**

d. Find the temperature at which there is 1%. Probability that a state with energy 0.5 eV above Fermi energy is occupied. **(04 Marks)**

OR

4 a. Derive an expression for electrical conductivity based on quantum free electron theory. **(06 Marks)**

b. Define mobility factor, drift velocity, mean collision time and relaxation time. **(04 Marks)**

c. What is superconductivity? Explain BCS theory of superconductivity. **(06 Marks)**

d. For intrinsic gallium arsenide at room temperature, the electrical conductivity is 10 $ohm^{-1}m^{-1}$. The electron and hole mobilities are 8.85 m^2/vs and 0.04 m^2/vs respectively. Calculate the intrinsic carrier concentration. **(04 Marks)**

Module-3

5 a. Obtain an expression for energy density of radiation under thermal equilibrium condition in terms of Einstein's coefficients. **(07 Marks)**

b. Explain the recording and reconstruction technique of holography. **(05 Marks)**

c. Discuss point to point optical fiber communication system with neat block diagram. **(05 Marks)**

d. Calculate V-number for an optical fiber of core diameter 45×10^{-6}m and with refractive indices 1.45 and 1.40 respectively for core and cladding when the wavelength of the propagation wave is 700×10^{-9}m. **(03 Marks)**

OR

6 a. Describe the construction and working of CO_2 laser with suitable diagrams and mention some important applications. **(08 Marks)**

b. *Explain the condition for lasing action.* **(04 Marks)**

c. Derive an expression for numerical aperture of an optical fiber and hence show the condition for propagation. The refractive indices of core and cladding are 1.50 and 1.48 respectively. Calculate the numerical aperture of an optical fiber. **(08 Marks)**

Module-4

7 a. Define atomic packing factor, calculate the atomic packing factor for SC, BCC and FCC structure. **(08 Marks)**

b. Explain in brief the seven crystal system with neat diagrams. **(07 Marks)**

c. What are Miller indices? Explain the procedure of finding Miller indices. **(05 Marks)**

OR

8 a. Describe the construction and working of Bragg's spectrometer and hence how it is used to determine crystal structure. **(08 Marks)**

b. Derive an expression for inter planar spacing in terms of Miller indices. **(06 Marks)**

c. Explain the crystal structure of diamond with neat sketch. **(06 Marks)**

Module-5

9 a. Explain the construction and working of Reddy shock tube and explain any three important applications. **(08 Marks)**

b. Describe the principle, construction and working of SEM with neat diagram. **(08 Marks)**

c. Explain the types of Carbon nano tubes with diagrams. **(04 Marks)**

OR

10 a. Explain Rankine-Hugoniot equations for a normal shock wave. **(06 Marks)**

b. Describe the top down approach of preparation of nanomaterials by ball milling method. **(05 Marks)**

c. Describe Arc discharge method of obtaining CNTs with neat diagram. **(05 Marks)**

d. Define Mach number, subsonic wave, ultrasonic wave and supersonic wave. **(04 Marks)**

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