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17PHY12/22

First/Second Semester B.E. Degree Examination, Aug./Sept.2020
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 :*** $h = 6.624\times10^{-34}$ ***JS,*** $m_e = 9.1\times10^{-31}$ ***kg.*** ***K*** $= 1.38\times10^{-23}\,J/K^{-1}$, $N_A = 6.023\times10^{23}$ /mole.

Module-1

1 a. Mention assumptions of Planck's radiation law. Show that Planck's law reduces to Wein's law and Rayleigh Jeans law at shorter and longer wavelength limits. **(06 Marks)**

b. Set up time independent Schrodinger wave equation in one dimension. **(06 Marks)**

c. Explain the energy distribution in the spectrum of a black body. **(04 Marks)**

d. Find group velocity and phase velocity of an electron with de Broglie wavelength 0.2nm. **(04 Marks)**

OR

2 a. State Heisenberg's Uncertainty Principle. Show that electron does not exist inside the nucleus. **(06 Marks)**

b. Define Phase Velocity and group velocity. Derive the relation between phase velocity and group velocity. **(06 Marks)**

c. Discuss Probability density for a particle in one dimensional potential well of infinite height for Ground and First excited states. **(04 Marks)**

d. An electron has a speed of 4.8×10^5 ms^{-1} accurate to 0.012%. With what accuracy can be located the position of electron? **(04 Marks)**

Module-2

3 a. Elucidate the difference between classical free Electron theory and Quantum Free Electron theory. **(06 Marks)**

b. Describe how BCS theory explains superconductivity. **(06 Marks)**

c. Define Relaxation time , Mean free path , Drift velocity. **(04 Marks)**

d. The resistivity of intrinsic germanium at 27^0 C is equal to 0.47Ωm. Assuming electron and hole mobilities as 0.38 and 0.18 $m^2\,V^{-1}S^{-1}$ respectively. Calculate the intrinsic carrier density. **(04 Marks)**

OR

4 a. State the law of mass action and derive the expression for electrical conductivity of a semiconductor. **(06 Marks)**

b. Define Fermi Energy. Discuss the probability of occupation of various energy states by electron at T = O K and T ≥ O K on the basis of Fermi Factor. **(05 Marks)**

c. What is Meissner effect? Distinguish between Type I and Type II super conductors. **(05 Marks)**

d. Calculate the probability of electron occupying an energy level 0.02eV above the Fermi level at temperature 200K. **(04 Marks)**

Module-3

5 a. Describe construction and working of semiconductor laser, with neat diagrams. **(06 Marks)**

b. Discuss point to point optical fiber communication system. **(05 Marks)**

c. Mention the application of laser and write a note on measurement of pollutants in atmosphere using laser. **(05 Marks)**

d. The ratio of population of two energy levels is 8.82×10^{-31}. Find the wavelength of light emitted at ambient temperature 27^0C. **(04 Marks)**

OR

6 a. What is Numerical Aperture? Obtain an expression for Numerical Aperture in optical fibers. **(05 Marks)**

b. Derive an expression for energy density of radiation in terms of Einstein's co-efficient. **(06 Marks)**

c. What is Attenuation? Explain any two factors contributing to fiber losses. **(05 Marks)**

d. A fiber 5m long has an input power of 8.6mW and output power 7.5mW. What is the attenuation of the fiber? **(04 Marks)**

Module-4

7 a. What is Bravais Lattice? Derive an expression for interplanar distance in terms of Miller Indices for cubic lattice. **(06 Marks)**

b. Explain the crystal structure of diamond with a neat diagram and calculate its APF. **(06 Marks)**

c. Derive Bragg's law. **(04 Marks)**

d. Draw the crystal planes [0 0 1] [1 2 1] [1 $\bar{1}$ 0] & [1 0 2]. **(04 Marks)**

OR

8 a. Explain the seven crystal systems, with neat diagrams. **(07 Marks)**

b. Define Allotropy and Polymorphism, with examples. What is Perovskite cystal? **(05 Marks)**

c. Calculate the atomic packing factor for SC and BCC. **(04 Marks)**

d. An X ray beam of wavelength 0.7^0A undergoes first order Bragg's reflection from the plane [302] of cubic crystal at glancing angle 35^0, calculate the lattice constant. **(04 Marks)**

Module-5

9 a. What is Carbon nanotube? Explain how it is synthesized using Arc – Discharge method. **(06 Marks)**

b. Describe construction and working of Reddy shock tube, with neat diagram. **(07 Marks)**

c. Distinguish between Ultrasonic, Subsonic and Supersonic waves. **(03 Marks)**

d. In a scanning electron microscope, electrons are accelerated through a potential difference of 200KV. Estimate the wavelength of the electrons in the scanning beam. **(04 Marks)**

OR

10 a. Explain the principle construction and working of scanning electron microscope, with neat diagram. **(07 Marks)**

b. What is a Shock Wave? Briefly explain Rankine – Hugoniot shock equations. **(05 Marks)**

c. What are Nanomaterials? Explain with neat diagram Ball – Milling method of synthesis of nanomaterials. **(05 Marks)**

d. Mention any three applications of CNT. **(03 Marks)**

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