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06PHY12/22

First/Second Semester B.E Degree Examination, Dec. 07 / Jan. 08
Engineering Physics

Time: 3 hrs. Max. Marks:100

Note : ***Answer any FIVE full questions choosing atleast TWO questions from each part.***

List the contents: i) Velocity of light $C = 3\times10^{8}$ m/s, ii) Planck's constant $h = 6.626\times10^{-34}$ J.s , iii) Boltzman constant $K = 1.38\times10^{-23}$ J/K, iv) Electron mass $m = 9.11\times10^{-31}$ kg. v) Electron charge $e = 1.6\times10^{-19}$C, vi) Permittivity of vacuum $\epsilon_0 = 8.85\times10^{-12}$ F/m

PART - A

1 a. Explain the energy distribution in the spectrum of a block body. Give an account of the attempts made through various laws to explain the spectrum. **(08 Marks)**

b. Define phase velocity and group velocity. Derive an expression for de-Broglie wavelength from group velocity. **(07 Marks)**

c. A particle of mass $0.65MeV/C^2$ has a kinetic energy 80eV. Calculate the deBroglie wavelength, group velocity and phase velocity of the deBroglie wave. **(05 Marks)**

2 a. Assuming the time independent Schrodinger wave equation, discuss the solution for a particle in one dimensional potential well of infinite height. Hence obtain the normalized wave function. **(08 Marks)**

b. Explain Heisenberg's uncertainty principle. Based on this, show the non-existence of electrons inside the nucleus. **(07 Marks)**

c. An electron is bond in one dimensional potential well of width 0.12nm. Find the energy values in the ground state and also the first two excited states in eV. **(05 Marks)**

3 a. Based on free electron theory, derive an expression for electrical conductivity of metals. How does electrical resistance change with impurity and temperature? **(09 Marks)**

b. Describe Fermi-Dirac distribution and discuss the same for different temperature conditions. **(06 Marks)**

c. The Fermi level in potassium is 2.1eV. What are the energies for which the probabilities of occupancy at 300 K are 0.99, 0.01 and 0.5? **(05 Marks)**

4 a. Explain the term internal field. Derive an expression for internal field in the case of one dimensional array of atoms in dielectric solids. **(08 Marks)**

b. Describe the nature of hard and soft magnetic materials. Discuss their applications. **(07 Marks)**

c. Sulphur is elemental solid dielectric whose dielectric constant is 3.4. Calculate the electronic polarisability if its density is 2.07×10^{3}kg/m^3 and atomic weight is 32.07. **(05 Marks)**

PART - B

5 a. Describe the construction and working of He-Ne laser with the help of energy level diagram. **(08 Marks)**

b. Describe the recording and reconstruction processes in Holography with the help of suitable diagrams. **(08 Marks)**

c. A He-Ne laser is emitting a beam with an average power of 4.5 mW. Find the number of photons emitted per second by the laser. The wavelength of the emitted radiation is $6328A^0$. **(04 Marks)**

6 a. What is Superconductivity? Describe type I and type II superconductors. **(08 Marks)**

b. Explain the different types of optical fiber, along with the refractive index profile and mode propagation sketches. **(07 Marks)**

c. Calculate the numerical aperture, fractional index change and V – number for a fibre of core diameter 40μm and with refractive indices of 1.55 and 1.50 respectively for core and cladding. The wavelength of the propagating wave is 1400 nm. Assume that the fibre is in air. **(05 Marks)**

7 a. Define coordination number and packing factor. Calculate the packing factor for SC and bCC structures. **(08 Marks)**

b. Describe how Bragg's spectrometer is used for determination of crystal structure. **(07 Marks)**

c. An X-ray beam of wavelength $0.7A^0$ undergoes minimum order Bragg reflection from the plane (302) of a cubic crystal at glancing angle 35^0. Calculate the lattice constant. **(05 Marks)**

8 a. Describe with theory a method of measuring velocity of ultrasonic waves in a liquid and mention how the bulk modulus of the liquid could be evaluated. **(08 Marks)**

b. What are nanomaterials? Write a note on carbon nanotubes. **(07 Marks)**

c. Discuss mechanical scaling. **(05 Marks)**

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