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14PHY12/22

First/Second Semester B.E. Degree Examination, Dec.2015/Jan.2016
Engineering Physics

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions, selecting atleast ONE full question from each part.***
2. Physical constants : Velocity of light, $C = 3 \times 10^8$ m/s ; Plank's constant, $h = 6.625 \times 10^{-34}$ J.S ; Mass of electrons, $m = 9.11 \times 10^{-31}$ kg ; Boltzmann's constant, $K = 1.38 \times 10^{-23}$ J/K. Avogadro number, $N_A = 6.02 \times 10^{26}$/K mole.

PART – 1

1 a. Define phase velocity and group velocity. Derive a relation between the two. **(05 Marks)**
b. What is the physical interpretation of wave function? Explain the nature of eigen values and eigen functions. **(06 Marks)**
c. Explain Wein's law and Rayleigh – Jean's law. Discuss their drawbacks. **(06 Marks)**
d. Calculate the de – Broglie wavelength associated with an electron carrying energy 2000 eV. **(03 Marks)**

2 a. State Heisenberg's uncertainity principle. Using uncertainity principle. Explain the non – existence of electron in the nucleus. **(07 Marks)**
b. Using time independent Schrodinger's wave equation, obtain the expression for the normalized wave function for a particle in one dimensional potential well of infinite height. **(09 Marks)**
c. The speed of electron is measured to within an uncertainity of 2.2×10^4 m/s in one – dimension. What is the minimum width required by the electron to be confined in an atom? **(04 Marks)**

PART – 2

3 a. Explain the probability of occupation of various energy state by electron at T = 0 K and T > 0 K on the basis of Fermi factor. **(06 Marks)**
b. Define Hall Effect and Hall Voltage. Derive an expression for Hall coefficient. **(06 Marks)**
c. Explain BCS theory of Super conductivity. **(04 Marks)**
d. Find the relaxation time of conduction electrons in a metal of resistivity 1.54×10^{-8} Ωm, if the metal has 5.8×10^{28} electrons/m^3. **(04 Marks)**

4 a. Discuss different types of super conductors. **(04 Marks)**
b. Explain Fermi – energy and Fermi - factor. **(06 Marks)**
c. Explain failure of Classical free electron theory. **(06 Marks)**
d. Calculate the Fermi velocity for the free electrons in gold. Given $E_F = 5.53$eV. **(04 Marks)**

PART – 3

5 a. Derive an expression for energy density in terms of Einstein's coefficients. **(08 Marks)**

b. Explain the construction and working of carbon dioxide laser device. **(08 Marks)**

c. The attenuation of light in an optical fiber is 3.6 dB/km. What fraction of its initial intensity remains after i) 1 km ii) after 3 km. **(04 Marks)**

6 a. What is Total internal reflection? Derive an expression for acceptance angle of an optical fiber. **(08 Marks)**

b. Discuss different types of optical fibres. **(06 Marks)**

c. An optical fiber has a numerical aperture of 0.32. The refractive index of cladding is 1.48. Calculate the refractive index of the core, the acceptance angle of the fiber and the fractional index change. **(06 Marks)**

PART – 4

7 a. Obtain the expression for inter planar spacing of a cubic crystal. **(05 Marks)**

b. Calculate the atomic packing factor for SC, FCC and BCC lattices. **(06 Marks)**

c. Write a note on Perovskite structure. **(06 Marks)**

d. A sodium chloride crystal is used as a diffraction grating with X – rays. For the d_{111} spacing of the chloride ions the angle of diffraction 2θ is 27.5^0. If the lattice constant of the crystal is 0.563nm, what is the wavelength of X – rays? **(03 Marks)**

8 a. What is Bragg's law? Explain how Bragg's spectrometer is used for determination of interplanar spacing in a crystal. **(08 Marks)**

b. Discuss the principle and working of Liquid Crystal Display. **(08 Marks)**

c. Draw (100) , (110), (011) and (111) planes in a Simple cubic crystal. **(04 Marks)**

PART – 5

9 a. Distinguish acoustic, subsonic and supersonic waves. **(04 Marks)**

b. Explain the preparation of nano structure using Sol – Gel method. **(06 Marks)**

c. Write a note on Carbon Nanotubes. **(06 Marks)**

d. What are Shock waves? Mention few applications of Shock wave. **(04 Marks)**

10 a. Explain the principle, construction and working of Reddy Shock tube. **(08 Marks)**

b. Explain the preparation of nano structures using Top – Down approach method. Mention any two properties of nano materials. **(06 Marks)**

c. Explain the construction and working of Scanning Electron Microscope. **(06 Marks)**

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