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14PHY12

First Semester B.E. Degree Examination, Dec.2014/Jan.2015
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 x 10^{8} m/s. Plank's constant, h = 6.625 x 10^{-34} J.S; Mass of electrons, m = 9.1 x 10^{-31} kg; Boltzmann's constant, If= 1.38 x 10^{-23} J/K. Avagadro number, NA = 6.02 x 10^{26}/K mole.

PART —1

1 a. Explain blackbody radiation spectrum on the basis of Plank's radiation law. (06 Marks)

b. Obtain the solution of Schrodinger's time-independent wave equation when applied to a potential box of infinite height. (07 Marks)

c. What is Compton effect? Explain its physical significance. (03 Marks)

d. The position and momentum of an electron with energy 0.5 keV are determined. What is the minimum percentage uncertainty in its momentum if the uncertainty in the measurement of its position is 0.5A°. (04 Marks)

2 a. What is phase velocity and group velocity in wave motion? Obtain a relation between them. (06 Marks)

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

c. Using Heisenberg's uncertainty principle, prove that electrons cannot exist in a nucleus. (04 Marks)

d. Calculate the wavelength associated with an electron having K.E. 100 eV. (04 Marks)

PART 2

3 a. What are the assumptions made in quantum free electron theory? Explain the success of this theory. (06 Marks)

b. What is Fermi level? Describe the variation of Fermi factor with temperatures.' (04 Marks)

c. Explain Meissner effect and the different types of superconductors. (06 Marks)

d. The electron concentration in an n-type semiconductor is 5 x 10' ^{7}/m^{3}. Neglecting the hole current, calculate the conductivity of the material if the drift velocity of the electrons is 350 m/s in an electric field of 1000 V/m. (04 Marks)

4 a. What is superconductivity? Explain superconductivity on the basis of BCS theory. (06 Marks)

b. Explain the law of mass action and derive the conductivity expression of a semi conductor. (06 Marks)

c. What is Fermi-Dirac statistics? Explain. (04 Marks)

d. The Fermi level in silver is 5.5 eV. Find the velocity of conduction electrons in silver. (04 Marks)

PART — 3

5 a. Mention the conditions for laser action. Explain the working of a semi conductor laser. **(08 Marks)**

b. Discuss the various loss factors in optical fibre communication. **(04 Marks)**

c. Derive the condition for propagation of light through an optical fibre. **(04 Marks)**

d. The average power of a laser beam of wavelength 6328A° is 5mW. Find the number of photons emitted per second by the laser source. **(04 Marks)**

6 a. What is Laser? Give the construction and working of carbon dioxide laser device. **(JO Marks)**

b. What are the different types of optical fibers? Explain. **(06 Marks)**

c. The attenuation in an optical fibre is 3.6 dB/km. What fraction of its initial intensity remains after 3km? **(04 Marks)**

PART — 4

7 a. What are Miller indices? Explain how axial intercepts in a crystal plane are converted into miller indices. **(04 Marks)**

b. Give the working principle of liquid crystal display. **(06 Marks)**

c. Find the atomic packing factor for SC, FCC and BCC structures. **(06 Marks)**

d. Determine the interplanar spacing for (110) planes for copper which has FCC structure and atomic radius 0.1278nm. **(04 Marks)**

8 a. Obtain an expression for the interplanar distance in a cubic crystal in terms of Miller indices. **(05 Marks)**

b. Sketch and explain the structure of diamond crystal. **(05 Marks)**

c. Explain how Bragg's law is verified using Bragg's X-ray spectrometer. **(06 Marks)**

d. Draw the crystal planes (2 1 0) and (1 0 l) in a cubic crystal. **(04 Marks)**

PART — 5

9 a. What are Shock waves? Explain the experimental method of producing shock waves and measuring its Mach number using Reddy's shock tube. **(08 Marks)**

b. Give the graphical representation of density of states with equation for OD, ID, 2D and 3D structures. **(08 Marks)**

c. What are the properties of carbon nanotubes? **(04 Marks)**

10 a. What are the ultrasonic and supersonic waves? Describe in brief how the normal shock relationships are arrived. **(08 Marks)**

b. Explain the working of SEM and its applications. **(08 Marks)**

t. Describe the arc discharge method of producing carbon nanotubes. **(04 Marks)**