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17PHY12

USN

First Semester B.E. Degree Examination, Dec.2017/Jan.2018
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, $c = 3 \times 10^{8}$ rn/s
        Planck's constant, $h = 6.63 \times 10^{-34}$ JS
        Mass of electron, $m_e = 9.1 \times 10^{31}$ kg
        Charge of electron, $e = 1.6 \times 10^{49}$ O
        Boltzmann constant $= 1.38 \times 10^{-23}$ JIC^{1}
        Avogadro number $= 6.02 \times 10^{23}$/moi

Module-1

1   a. Write the assumptions of Planck's law of radiation. Deduce Wein's law and Rayleigh-Jeans law from Planck's law of radiation. **(07 Marks)**
    b. Set up time independent one dimensional Schrodinger wave equation. **(06 Marks)**
    C. What is Compton effect? Explain its physical significance.t **(03 Marks)**

    d. An electron is bound in an one dimensional potential well of width 1 A , but if infinite wall height. Find its energy values in the ground state, and also in the first excited states. **(04 Marks)**

OR

2   a. State Heisenberg's uncertainty principle. Show t!-at electrons cannot exist inside the nucleus. **(07 Marks)**
    b. State de Broglie hypothesis and show that group velocity is equal to particle velo city. **(06 Marks)**
    c. Briefly explain three properties of wave function. **(03 Marks)**
    d. Compute the de Broglie wavelength for an electron moving with one tenth part of the velocity of light. **(04 Marks)**

Module 2

3   a. Explain Fermi energy and Fermi factor. Explain the variatioa of Fermi factor with temperature. **(07 Marks)**
    b. Derive the expression for electrical conductivity of an intrinsic semiconductor. **(05 Marks)**
    c. Write a note on Meglave vehicles. **(04 Marks)**
    d. The electron concentration in a semiconductor is $5 \times 10^{"}$ m^{-3}. Calculate the conductivity of the material if the drift velocity of electron is 350 ms^{-1} in an electric field of 1000 Vm^{-1}. **(04 Marks)**

OR

4   a. Discuss the merits of quantum electron theory. **(06 Marks)**
    b. What is superconductivity? Explain Type-I and Type-11 superconductors. **(06 Marks)**
    C. What is (i) mean collision time, (ii) drift velocity, (iii) Meissner effect? **(04 Marks)**
    d. Calculate the Fermi velocity and the mean path for the conduction electrons in silver, given that its Fermi energy is 5.5 eV and the relaxation time for electrons is 3.83 x 0-1 4 S. **(04 Marks)**

Important Note : 1. On completing y
            2. Any revealing of

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Module-3

5 a. Define angle of acceptance and numerical aperture. Obtain an expression for the numerical aperture of an optical fiber. **(07 Marks)**
   b. What is holography? Explain the principle of construction of hologram with suitable ray diagram. **(05 Marks)**
   c. Explain the processes of spontaneous emission and stimulated emission. **(04 Marks)**
   d. A medium in thermal equilibrium at temperature 300 K has two energy levels with a wavelength separation of 1   Find the ratio of population densities of the upper and lower levels. **(04 Marks)**

OR

6 a. Describe the construction of CO, laser and explain its working with the help of energy level diagram. **(06 Marks)**
   b. discuss the three types of optical fibers with suitable diagrams. **(06 Marks)**
   c. Mention four applications of LASER. **(04 Marks)**
   d. The angle of acceptance of an optical fiber is 30° when kept in air. Find the angle of acceptance when it is in a medium of refractive index 1.33. **(04 Marks)**

Module-4

7 a. Explain in brief the seven crystal systems with neat diagrams. **(07 Marks)**
   b. Explain the crystal structure of diamond with neat sketch and calculate its atomic packing factor. **(06 Marks)**
   c. Define unit cell, primitive cell and Bravias lattice. **(03 Marks)**
   d. Calculate the glancing angle for incidence of x-rays of wavelength 0.58 Å on the plane (132) of NaC,E which results in second order diffraction maxima taking the lattice constant as 3.81A . **(04 Marks)**

OR

8 a. What are Miller indices? Derive an expression for interplanar distance interms of Miller indices. **(07 Marks)**
   b. Define coordination number and packing factor. Calculate the packing factor for SCC and FCC structure. **(06 Marks)**
   c. Derive Bragg's law. **(04 Marks)**
   d. Draw the following planes in a cubic unit cell: i) **(1 1 1)**   ii) (1 0 1)   iii) (0 1 **1**). **(03 Marks)**

Module-5

9 a. Describe the construction and working of Reddy's shock tube. **(06 Marks)**
   b. Discuss the variation of density of energy states for 3D, 2D, 1D and OD structures. **(06 Marks)**
   c. Describe soi gel method of producing nano particles. **(05 Marks)**
   d. Mention any three applications of nano particles. **(03 Marks)**

OR

10 a. Describe the principle, construction and working of a scanning electron microscope. **(08 Marks)**
    b. Define: 1) Mach number   ii) Subsonic waves
                iii) Supersonic waves   iv) Ultrasonic waves. **(04 Marks)**
    c. Explain pyrolysis method of obtaining carbon nanotubes. **(04 Marks)**
    d. The distance between the two pressure sensors in a shock tube is 100 mm. The time taken by a shock wave to travel this distance is 100 microsecond. If the velocity of sound under the same conditions is 340 ms^{-1} , find the Mach number of the shock wave. **(04 Marks)**