CBCS Scheme

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17PHY12

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, $c = 3 \times 10^8$ m/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, $e = 1.6 \times 10^{-19}$ C
Boltzmann constant = 1.38×10^{-23} JK^{-1}
Avagadro number = 6.02×10^{23}/mol

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. **(03 Marks)**

d. An electron is bound in an one dimensional potential well of width 1 Å, 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 that electrons cannot exist inside the nucleus. **(07 Marks)**

b. State de Broglie hypothesis and show that group velocity is equal to particle velocity. **(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 variation 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 5×10^{17} 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 free electron theory. **(06 Marks)**

b. What is superconductivity? Explain Type-I and Type-II 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 free path for the conduction electrons in silver, given that its Fermi energy is 5.5 eV and the relaxation time for electrons is 3.83×10^{-14} S. **(04 Marks)**

Module-3

5 a. Define angle of acceptance and numerical aperture. Obtain an expression for the numerica 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 μm. Find the ratio of population densities of the upper and lower levels. **(04 Marks)**

OR

6 a. Describe the construction of CO_2 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 NaCℓ which results in second order diffraction maxima taking the lattice constant as 3.81 Å. **(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 $\bar{1}$ 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 0D structures. **(06 Marks)**

c. Describe sol 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: i) Mach number ii) Subsonic waves
ii) 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)**

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