CBCS Scheme

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15PHY12/22

First/Second Semester B.E. Degree Examination, June/July 2016
Engineering Physics

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing one full question from each module.
2. Physical Constants: Planck's constant h = 6.63×10^{-34} JS, Mass of electron m = 9.11×10^{-31} kg, Boltzmann constant K = 1.38×10^{-23} JK^{-1}, Avogadro number $N_A = 6.025 \times 10^{26}$/K mol, Velocity of light C = 3×10^{8} ms^{-1}.

Module-1

1 a. Mention the assumptions of Planck's law. Arrive at the relation for Wien's law from Planck's law. **(06 Marks)**

b. State Heisenberg's uncertainty principle. Show that electrons cannot exist inside the nucleus. **(06 Marks)**

c. Calculate the deBroglie wavelength associated with neutron of mass 1.674×10^{-27} kg with one tenth part of the velocity of light. **(04 Marks)**

OR

2 a. What is phase velocity and group velocity? Show that group velocity is equal to particle velocity. **(06 Marks)**

b. Obtain normalized wave function, with respect to a particle inside an one dimensional potential well. **(06 Marks)**

c. An electron is bound in one dimensional potential well of width 0.18 nm. Find the energy value in eV of the second excited state. **(04 Marks)**

Module-2

3 a. Explain the failure of classical free electron theory. **(06 Marks)**

b. State law of mass action and derive the expression for electrical conductivity of a semiconductor. **(06 Marks)**

c. A superconducting tin has a critical field of 306 gauss at 0 K and 217 gauss at 2 K. Find the critical temperature of superconducting tin. **(04 Marks)**

OR

4 a. What is Fermi factor? Discuss the variation of fermifactor with temperature. **(06 Marks)**

b. Write a note on High temperature super conductors. **(06 Marks)**

c. Calculate the mobility of electrons in copper assuming that each atom contribute one free electron for conduction. Resistivity of copper = 1.7×10^{-8} Ωm, atomic weight = 63.54, density = 8.96×10^{3} kg/m^3. **(04 Marks)**

Module-3

5 a. Explain the construction and working of semiconductor laser. **(06 Marks)**

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

c. The ratio of population of two energy levels out of which one corresponds to metastable state is 1.059×10^{-30}. Find the wavelength of light emitted at 330 K. **(04 Marks)**

OR

6 a. Describe the recording and reconstruction process in holography with the help of suitable diagrams. **(06 Marks)**

b. What is attenuation? Explain the factors contributing to the fibre loss. **(06 Marks)**

c. The refractive indices of the core and cladding of a step-index optical fibre are 1.45 and 1.40 respectively and its core diameter is 45 μm. Calculate its fractional refractive index change and numerical aperture. **(04 Marks)**

Module-4

7 a. Define unit cell. Derive the expression for the interplanar spacing in terms of Miller indices. **(06 Marks)**

b. Calculate the glancing angle for incidence of X-rays of wave length 0.058 nm on the plane (1 3 2) of NaCl which results in 2nd order diffraction maxima taking the lattice spacing as 3.81 Å. **(06 Marks)**

c. Calculate the atomic packing factor for SC, bCC and fCC. **(04 Marks)**

OR

8 a. Describe the construction and working of a Bragg's X-ray spectrometer. **(06 Marks)**

b. Explain the crystal structure of diamond with neat sketch and calculate its atomic packing factor. **(06 Marks)**

c. Monochromatic X-rays of wavelength 0.82 Å undergo first order Bragg reflection from a crystal of cubic lattice with lattice constant 3 Å at a glancing angle of 7.855°. Identify the possible planes which give rise to this reflection in terms of their Miller indices. **(04 Marks)**

Module-5

9 a. What is Mach number? Define subsonic and supersonic with Mach number and give example. **(06 Marks)**

b. Describe the synthesis of carbon nanotubes using Pyrolysis method. **(06 Marks)**

c. In a Reddy tube experiment, it was found that, the time taken to travel between the two sensors is 195 μs. If the distance between the two sensors is 100 mm, find the Mach number. **(04 Marks)**

OR

10 a. Describe the construction and working of Reddy's shock tube. **(06 Marks)**

b. Explain the structure of carbon nanotube. **(06 Marks)**

c. Calculate the wavelength of an electron accelerated under a potential difference of 100 V in scanning electron microscope. **(04 Marks)**

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