CBCS SCHEME

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15PHY12/22

First/Second Semester B.E. Degree Examination, Feb./Mar. 2022
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, $h = 6.63\times 10^{-34}$ JS***
Mass of electron, $m = 9.11 \times 10^{-31}$ kg
Boltzmann constant, $k = 1.38 \times 10^{-23}$ J/K
Avagadro number, $N_A = 6.025 \times 10^{26}$ per Kmole
Velocity of light, $c = 3 \times 10^{8}$ m/s
Electron charge, $e = 1.6 \times 10^{-19}$ C
1 electron volt = 1.6×10^{-19} J

Module-1

1 a. Show how Planck's law of radiation reduces to Wein's law and Rayleigh Jean's law. **(06 Marks)**

b. State Heisenberg's uncertainty principle and explain non-existence of electrons inside the nucleus by this principle. **(06 Marks)**

c. A particle of mass 0.65 Mev/C^2 has a kinetic energy 80eV. Find the deBroglie wavelength. **(04 Marks)**

OR

2 a. Define phase velocity and group velocity and derive a relation between group velocity and particle velocity. **(05 Marks)**

b. Set up time independent Schrodinger wave equation in one dimension. **(07 Marks)**

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

Module-2

3 a. Explain the merits of quantum free electron theory. **(06 Marks)**

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

c. Explain in brief BCS theory of superconductivity. **(04 Marks)**

OR

4 a. What is Fermi energy? Discuss the variation of fermifactor with temperature. **(07 Marks)**

b. Explain Type-I and Type-II superconductors. **(05 Marks)**

c. The resistivity of instrinsic Germanium at 27°C is equal to 0.47 Ωm. Assuming electron and hole mobilites as 0.38 and 0.18 m^2/v/s respectively. Calculate the intrinsic carrier density. **(04 Marks)**

Module-3

5 a. Obtain an expression for energy density of radiation in terms of Einsteins coefficients. **(06 Marks)**

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

c. Find the ratio of population of two energy levels out of which one corresponds to metastable state of the wavelength of light emitted at 330 K is 632.8 nm. **(04 Marks)**

OR

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

b. Define angle of acceptance and numerical aperture and hence obtain an expression for angle of acceptance and numerical aperture. **(06 Marks)**

c. Calculate the numerical aperture and angle of acceptance for an optical fiber having refractive indices 1.50 and 1.48 for core and cladding respectively. **(04 Marks)**

Module-4

7 a. Describe Seven crystal system with neat diagram. **(07 Marks)**

b. Describe the construction and working of Bragg's x-ray spectrometer. **(05 Marks)**

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

OR

8 a. What are Miller indices? Obtain an expression for interplanar spacing in cubic crystal interms of Miller indices. **(07 Marks)**

b. Calculate atomic packing factor of sc, bcc and fcc. **(05 Marks)**

c. Derive Bragg's law of diffraction. **(04 Marks)**

Module-5

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

b. What are the basic methods of synthesis of nanomaterials? Describe in brief the Ball Milling method of synthesis of nanomaterials. **(06 Marks)**

c. Mention important applications of carbon nanotube. **(04 Marks)**

OR

10 a. Explain the principle, construction and working of SEM. **(07 Marks)**

b. Describe the synthesis of carbon nanotubes using pyrolysis method. **(05 Marks)**

c. The distance between the two pressure sensors in a shock tube is 150 mm. The time taken by a shock wave to travel this distance is 0.3 millisec. If the velocity of sound under the same condition is 340 m/s. Find the Mach number of the shock wave. **(04 Marks)**

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