CBCS SCHEME

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17PHY12/22

First/Second Semester B.E. Degree Examination, June/July 2019
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, $c = 3 \times 10^8$ ms^{-1}
Mass of electron, $m_o = 9.1 \times 10^{-31}$ kg
Boltzmann constant, $K_B = 1.38 \times 10^{-23}$ J/k
Charge of an electron, $e = 1.6 \times 10^{-19}$ C
Avagadro number, $N_A = 6.02 \times 10^{26}$/k mole

Module-1

1 a. What is ultraviolet catastrophe? Discuss in brief Wien's law and Rayleigh-Jeans law to explain blackbody radiation. **(06 Marks)**

b. Solve the Schrodinger's wave equation for the allowed energy values in the case of particle in a box and also find eigen function for the same and represent with figure. **(10 Marks)**

c. Calculate the wavelength associated with an electron having a kinetic energy of 100 eV. **(04 Marks)**

OR

2 a. Define group velocity and phase velocity. Derive the relation between the two. **(06 Marks)**

b. Mention the properties of the wave function. Set up time-independent one-dimensional Schrodinger's equation. **(10 Marks)**

c. In a measurement that involved a maximum uncertainty of 0.003%, the speed of an electron was found to be 800 ms^{-1}. Calculate the corresponding uncertainty involved in determining its position. **(04 Marks)**

Module-2

3 a. Define the following terms: (i) Drift velocity (ii) Relaxation time. Discuss the drawbacks of classical free electron theory in metals. **(08 Marks)**

b. Define critical magnetic field. Explain types of super conductors. Mention applications of super conductors. **(08 Marks)**

c. The effective mass of an electron in Silicon (Si) is 0.31 m_o, where m_o is free electron mass. Find the electron concentration for Si at 300 K, assuming that Fermi level lies exactly in the middle of energy gap. Given energy gap of Si = 1.1 eV. **(04 Marks)**

OR

4 a. Briefly explain Fermi-Dirac statistics and discuss the dependence of Fermi-factor on temperature. **(06 Marks)**

b. State and explain Meissner effect. **(05 Marks)**

c. Explain BCS theory for superconductivity. **(05 Marks)**

d. The resistivity of intrinsic Silicon at 27°C is 3000 Ωm. Assuming electron and hole mobilities of 0.17 m^{2}V^{-1}S^{-1} and 0.035 m^{2}V^{-1}S^{-1} respectively. Calculate intrinsic carrier concentration. **(04 Marks)**

Module-3

5 a. Explain construction and working of semiconductor laser with the help of energy band diagram. **(07 Marks)**

b. Describe recording and reconstruction process in holography with the help of suitable diagram. Mention its applications. **(09 Marks)**

c. A medium in thermal equilibrium at temperature 300K 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. Obtain an expression for energy density of radiation under equilibrium condition in term of Einstein's coefficients. **(06 Marks)**

b. Discuss types of optical fibers using suitable diagrams. **(06 Marks)**

c. Explain point to point communication system using optical fiber with block diagram. **(04 Marks)**

d. The attenuation of light in an optical fibre is estimated as 2.2 dB/km. What fractional initial intensity remains after 2 km and 6 km? **(04 Marks)**

Module-4

7 a. What are Miller Indices? Show that for cubic the distance between two successive plane $(h\,k\,\ell)$ is given by $d = \frac{a}{\sqrt{h^2 + k^2 + \ell^2}}$. **(07 Marks)**

b. Define coordination number, atomic radius and atomic packing factor. Find atomic packing factor for SC, BCC and FCC. **(09 Marks)**

c. X-rays of wavelength 1.541 $\overset{o}{A}$ are diffracted by (1 1 1) planes in a crystal at an angle of 30° in the first order. Calculate the inter atomic spacing. **(04 Marks)**

OR

8 a. Explain the procedure followed to specify crystal planes using Miller indices with an example. **(05 Marks)**

b. State and explain Bragg's law. Describe how Bragg's spectrometer is used to determine the wavelength of an x-ray beam. **(10 Marks)**

c. Draw following planes in cubic unit cell (100) (110) (011) (111) (001). **(05 Marks)**

Module-5

9 a. Explain the construction and working of scanning electron microscope. Mention its applications. **(10 Marks)**

b. Explain Ball-Milling method of synthesis of nanomaterials. **(06 Marks)**

c. Write any four applications of carbon nano tube. **(04 Marks)**

OR

10 a. Explain top-down and bottom-up approach in synthesis of nano-materials. **(06 Marks)**

b. Explain the construction and working of Reddy's shock tube. **(06 Marks)**

c. Describe the various quantum structures. **(08 Marks)**

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