CBCS SCHEME

First/Second Semester B.E. Degree Examination, Aug./Sept.2020
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 :* $h = 6.624 \times 10^{-34} JS$, $m_e = 9.1 \times 10^{-31} kg$. $K = 1.38 \times 10^{-23} J/K^{-1}$,
$N_A = 6.023 \times 10^{23} /mole$.

Module-1

1 a. Mention assumptions of Planck's radiation law. Show that Planck's law reduces to Wein's law and Rayleigh Jeans law at shorter and longer wavelength limits. **(06 Marks)**
   b. Set up time independent Schrodinger wave equation in one dimension. **(06 Marks)**
   c. Explain the energy distribution in the spectrum of a black body. **(04 Marks)**
   d. Find group velocity and phase velocity of an electron with de Broglie wavelength 0.2nm. **(04 Marks)**

OR

2 a. State Heisenberg's Uncertainty Principle. Show that electron does not exist inside the nucleus. **(06 Marks)**
   b. Define Phase Velocity and group velocity. Derive the relation between phase velocity and group velocity. **(06 Marks)**
   c. Discuss Probability density for a particle in one dimensional potential well of infinite height for Ground and First excited states. **(04 Marks)**
   d. An electron has a speed of $4.8 \times 10^5 \ ms^{-1}$ accurate to 0.012%. With what accuracy can be located the position of electron? **(04 Marks)**

Module-2

3 a. Elucidate the difference between classical free Electron theory and Quantum Free Electron theory. **(06 Marks)**
   b. Describe how BCS theory explains superconductivity. **(06 Marks)**
   c. Define Relaxation time , Mean free path , Drift velocity. **(04 Marks)**
   d. The resistivity of intrinsic germanium at 27^0 C is equal to 0.47Ωm. Assuming electron and hole mobilities as 0.38 and 0.18 $m^2 \ V^{-1}S^{-1}$ respectively. Calculate the intrinsic carrier density. **(04 Marks)**

OR

4 a. State the law of mass action and derive the expression for electrical conductivity of a semiconductor. **(06 Marks)**
   b. Define Fermi Energy. Discuss the probability of occupation of various energy states by electron at T = O K and T ≥ O K on the basis of Fermi Factor. **(05 Marks)**
   c. What is Meissner effect? Distinguish between Type I and Type II super conductors. **(05 Marks)**
   d. Calculate the probability of electron occupying an energy level 0.02eV above the Fermi level at temperature 200K. **(04 Marks)**

Module-3

5 a. Describe construction and working of semiconductor laser, with neat diagrams. (06 Marks)
   b. Discuss point to point optical fiber communication system. (05 Marks)
   c. Mention the application of laser and write a note on measurement of pollutants in atmosphere using laser. (05 Marks)
   d. The ratio of population of two energy levels is 8.82×10^{-31}. Find the wavelength of light emitted at ambient temperature 27^0C. (04 Marks)

OR

6 a. What is Numerical Aperture? Obtain an expression for Numerical Aperture in optical fibers. (05 Marks)
   b. Derive an expression for energy density of radiation in terms of Einstein's co-efficient. (06 Marks)
   c. What is Attenuation? Explain any two factors contributing to fiber losses. (05 Marks)
   d. A fiber 5m long has an input power of 8.6mW and output power 7.5mW. What is the attenuation of the fiber? (04 Marks)

Module-4

7 a. What is Bravais Lattice? Derive an expression for interplanar distance in terms of Miller Indices for cubic lattice. (06 Marks)
   b. Explain the crystal structure of diamond with a neat diagram and calculate its APF. (06 Marks)
   c. Derive Bragg's law. (04 Marks)
   d. Draw the crystal planes [0 0 1] [1 2 1] [1 $\bar{1}$ 0] & [1 0 2]. (04 Marks)

OR

8 a. Explain the seven crystal systems, with neat diagrams. (07 Marks)
   b. Define Allotropy and Polymorphism, with examples. What is Perovskite cystal? (05 Marks)
   c. Calculate the atomic packing factor for SC and BCC. (04 Marks)
   d. An X ray beam of wavelength 0.7^0A undergoes first order Bragg's reflection from the plane [302] of cubic crystal at glancing angle 35^0, calculate the lattice constant. (04 Marks)

Module-5

9 a. What is Carbon nanotube? Explain how it is synthesized using Arc – Discharge method. (06 Marks)
   b. Describe construction and working of Reddy shock tube, with neat diagram. (07 Marks)
   c. Distinguish between Ultrasonic, Subsonic and Supersonic waves. (03 Marks)
   d. In a scanning electron microscope, electrons are accelerated through a potential difference of 200KV. Estimate the wavelength of the electrons in the scanning beam. (04 Marks)

OR

10 a. Explain the principle construction and working of scanning electron microscope, with neat diagram. (07 Marks)
    b. What is a Shock Wave? Briefly explain Rankine – Hugoniot shock equations. (05 Marks)
    c. What are Nanomaterials? Explain with neat diagram Ball – Milling method of synthesis of nanomaterials. (05 Marks)
    d. Mention any three applications of CNT. (03 Marks)

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