CBCS SCHEME

15PHY12/22

USN | | | | | | | | | |

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× 10⁻³⁴JS*
      Mass of electron, m = 9.11 × 10⁻³¹kg
      Boltzmann constant, k = 1.38 × 10⁻²³J/K
      Avagadro number, N_A = 6.025 × 10²⁶ per Kmole
      Velocity of light, c = 3 ×10⁸ m/s
      Electron charge, e = 1.6 × 10⁻¹⁹C
      1 electron volt = 1.6 × 10⁻¹⁹J

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 m²/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)

* * * * *