CBCS SCHEME

USN | | | | | | | | | | |

15PHY12/22

First/Second Semester B.E. Degree Examination, June/July 2023
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 ; Avogadro number, $N_A = 6.025 \times 10^{26}$/Kmol ; Velocity of light, $C = 3 \times 10^8$ m/s ; Electron charge $e = 1.6 \times 10^{-19}$ C, 1 electron volt $= 1.6 \times 10^{-19}$ J.***

Module-1

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

b. Set up time independent Schrodinger wave equation in one dimension. **(06 Marks)**

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

OR

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

b. State Heisenberg's uncertainty principle. Explain non-existence of electron in the nucleus. **(06 Marks)**

c. An electron is bound in one dimensional potential 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. **(06 Marks)**

b. What is superconductivity? Explain Type-I and Type-II super conductors. **(06 Marks)**

c. For intrinsic gallium arsenide, the room temperature electrical conductivity is 10^{-6} per ohm meter. The electron and hole mobility are respectively 0.85 m^2/vs and 0.04 m^2/vs. Calculate the intrinsic carrier concentration at room temperature. **(04 Marks)**

Module-3

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

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

c. Find the ratio of population of two energy levels if 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 numerical aperture and angle of acceptance. **(06 Marks)**

c. The attenuation of an optical fiber is –3.6 dB/km. What is the fraction of light intensity that remains after (i) 1 km (ii) 3 km? **(04 Marks)**

Module-4

7 a. Describe any 6 crystal system with neat diagram. **(06 Marks)**

b. Describe how the crystals structure can be determined using Bragg's x-ray spectrometer. **(06 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 Miller indices. **(06 Marks)**

b. Calculate atomic packing factor of SC, BCC and FCC. **(06 Marks)**

c. Derive an expression for Bragg's law of diffraction in crystals. **(04 Marks)**

Module-5

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

b. What are nanomaterials? Describe in brief the Ball Milling method of synthesis of nanomaterials. **(07 Marks)**

c. Calculate the wavelength of an electron accelerated under a potential difference of 200 V in scanning electron microscope. **(03 Marks)**

OR

10 a. Describe the principle, construction and working of SEM. **(06 Marks)**

b. Discuss important properties and applications of carbon nanotube. **(06 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 ms. If the velocity of sound under the same condition is 340 m/s. Find the Mach number of the shock wave. **(04 Marks)**

* * * * *