

CBCS SCHEME

15PHY12/22



First/Second Semester B.E. Degree Examination, July/August 2022 Engineering Physics

Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.

- 2. Physical constants :** Velocity of light, $c = 3 \times 10^8$ m/s,
Planck's constant, $h = 6.625 \times 10^{-34}$ J-S
Mass of electron, $m = 9.1 \times 10^{-31}$ kg
Boltzmann constant, $k = 1.38 \times 10^{-23}$ JK⁻¹
Avagadro number, $N_A = 6.023 \times 10^{26}$ / K mol.

Module-1

- 1 a. Explain Compton effect and give its physical significance. (04 Marks)
b. Using time – independent Schrodinger wave equation, derive an expression for energy eigen value, eigen function, zero – point energy and normalization of wave function of a particle in a one dimensional potential well of infinite height. (08 Marks)
c. What is the minimum uncertainty in the energy state of an atom. If an electron remain in this state for 10^{-9} seconds. (04 Marks)

OR

- 2 a. What is Wave function? Give its properties and physical significances. (05 Marks)
b. Define Phase Velocity and Group Velocity. Derive the relation between them in terms of wavelength ' λ '. (07 Marks)
c. An electron at rest is accelerated through a potential of 150.7V. Calculate the de – Broglie wavelength of Mattu – wave associated with it. (04 Marks)

Module-2

- 3 a. State and explain "Relaxation time" and "Drift velocity" of conduction electrons. (04 Marks)
b. Explain Meissner effect and BCS theory of superconductivity. (08 Marks)
c. A uniform silver wire has a resistivity of 1.54×10^{-8} Ω - m at room temperature. For an electric field of 1 V cm⁻¹, calculate i) the drift velocity and ii) the mobility of electrons assuming that there 5.8×10^{28} conduction electrons per m³ of the material. (04 Marks)

OR

- 4 a. Explain 'Fermi factor'. Discuss three different cases of Probability of occupation of various energy states by electrons at $T = 0^\circ$ K and $T > 0^\circ$ K. On the basis of Fermi factor. (08 Marks)
b. Write a short note on Maglev vehicles. (04 Marks)
c. Calculate the probability of finding an electron at energy 0.02 eV above Fermi level at 290K. (08 Marks)

Module-3

- 5 a. Explain the construction and working of semiconductor LASER. (06 Marks)
b. What is Stimulated Emission? Derive an expression for energy density of radiation in terms of Einstein's A & B coefficients. (06 Marks)
c. The refractive index of core and cladding for a step – index optical fibres are 1.518 and 1.42 respectively. Calculate the Numerical aperture and Acceptance angle. (04 Marks)

OR

- 6 a. With a neat diagram, explain three different types of Optical fibre and write one advantage of graded index over step index. (07 Marks)
- b. What is Attenuation coefficient in an Optical fibre? Explain two attenuation mechanisms. (05 Marks)
- c. The ratio of population of two energy levels is 1.059×10^{-30} . Find the wavelength of light radiation emitted at 310K. (04 Marks)

Module-4

- 7 a. With a neat diagram, explain Seven Crystal system. (07 Marks)
- b. What is Atomic Packing Factor? Calculate the Atomic packing factor for SC and FCC structures. (05 Marks)
- c. The lattice constant for a unit cell of aluminum is 4.04\AA . What is the distance between the planes with Miller – indices : i) (200) ii) (110) iii) (111). (04 Marks)

OR

- 8 a. What are Miller Indices and derive Bragg's law for X – ray diffraction. (06 Marks)
- b. Explain how Bragg's spectrometer is used to determine the interplanar distance of a crystal. (06 Marks)
- c. In an Orthorhombic crystal, a lattice plane cuts the intercepts of length $3a$, $2b$ and $3c/2$ along three axis. Obtain the Miller indices of the plane, where a , b and c are primitive vertices of the unit cell. (04 Marks)

Module-5

- 9 a. What is Mach Number? Explain the difference between Ultrasonic and Supersonic waves. (04 Marks)
- b. Explain the Sol – Gel method of synthesis of Nano materials. (05 Marks)
- c. Explain with principle, the working of Scanning Electron Microscope. (07 Marks)

OR

- 10 a. What is a Carbon nano tube? Write down properties and application of Carbon Nano Tube. (05 Marks)
- b. What are Shock Waves? Describe the construction and working of Reddy's Shock tube. (07 Marks)
- c. Calculate the distance between the sensors, if the Mach number is 2 and time taken by the shock wave to travel the distance is $50\mu\text{s}$, given velocity of sound in the medium is 2200 ms^{-1} . (04 Marks)
