

CBCS Scheme

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17PHY12/22

First/Second Semester B.E. Degree Examination, June/July 2018 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 : $C = 3 \times 10^8 \text{ m/s}$, $h = 6.63 \times 10^{-34} \text{ JS}$, $K = 1.38 \times 10^{-23} \text{ J/K}$,
 $m = 9.11 \times 10^{-31} \text{ kg}$, $e = 1.6 \times 10^{-19} \text{ C}$, $NA = 6.02 \times 10^{26} \text{ kmol}$.

Module-1

- 1 a. Define a black body. Deduce Wien's law and Rayleigh Jeans law from Planks law of Radiation. (07 Marks)
- b. Set – up One dimensional time independent Schrodinger wave equation. (06 Marks)
- c. Explain the energy distribution in the spectrum of Black body. (03 Marks)
- d. An electron is bound in one dimensional potential well of width 0.12nm. Find the energy values in the ground state and also in first two excited states. (04 Marks)

OR

- 2 a. State Heisenberg's Uncertainty Principle. Show that free electrons cannot exist inside the nucleus. (07 Marks)
- b. Define Phase Velocity and Group Velocity. Derive the relation between them. (06 Marks)
- c. Write a note on Compton effect. (03 Marks)
- d. A particle of mass $0.65 \text{ MeV}/c^2$ has free energy 120MeV. Find its deBroglie wavelength. [Where 'C' is speed of light]. (04 Marks)

Module-2

- 3 a. What is Fermi Factor? Discuss the variation of Fermi factor with temperature. (07 Marks)
- b. What is Superconductivity? Explain Type – I and Type – II superconductors. (06 Marks)
- c. Define : i) Mean collision time ii) Relaxation time iii) Drift velocity. (03 Marks)
- d. Find the probability that an energy level at 0.2eV below fermi level being occupied at temperatures 300K and 1000K. (04 Marks)

OR

- 4 a. Derive the expression for electrical conductivity by using Quantum free electron theory in case of metals. (07 Marks)
- b. Explain the failures of CFET. (Classical Free Electron Theory). (06 Marks)
- c. Write a note on High temperature superconductors. (03 Marks)
- d. The electron and hole mobilities of silicon are $0.14 \text{ m}^2\text{V}^{-1}\text{S}^{-1}$ and $0.05 \text{ m}^2\text{V}^{-1}\text{S}^{-1}$ respectively at a certain temperature. If the electron density is $1.5 \times 10^{16} \text{ electrons/m}^3$ then calculate the resistivity of silicon. (04 Marks)

Module-3

- 5 a. Obtain an expression for energy density of radiation in terms of Einsteins co-efficient. (07 Marks)
- b. Write a note on different types of optical fibers. (06 Marks)
- c. Mention any three applications of LASERS. (03 Marks)
- d. Calculate the Numerical aperture, V – number and number of modes in an optical fibre of core diameter 50 μm . Refractive indices are 1.41 and 1.40 respectively at wavelength of 820nm. (04 Marks)

OR

- 6 a. Explain the construction and working of CO₂ Laser with the help of energy level diagram. (07 Marks)
- b. What is Holography? With a neat diagram, explain the recording and reconstruction process of a Hologram. (06 Marks)
- c. Define : i) Numerical Aperture ii) Angle of Acceptance iii) Attenuation. (03 Marks)
- d. Find the ratio of the populations of the two states in a material that produces light of wavelength 6328 Å at 27°C. (04 Marks)

Module-4

- 7 a. What are Miller Indices? Derive an expression for Interplanar distances in terms of Miller Indices. (07 Marks)
- b. Explain Bragg's X-ray Spectrometer. (06 Marks)
- c. Define : i) Unit cell ii) Bravais Lattice iii) Primitive cell. (03 Marks)
- d. Draw the following planes in a cubic unit cell :
i) (1 1 1) ii) (0 2 0) iii) (1 $\bar{1}$ 2) iv) (3 0 1). (04 Marks)

OR

- 8 a. Explain in brief the Seven Crystal systems, with neat diagrams. (07 Marks)
- b. Explain the crystal structure of diamond. (05 Marks)
- c. Calculate APF for BCC and FCC structures. (04 Marks)
- d. X-rays are diffracted in the first order from (110) plane of cubic crystal with lattice constant 3.036 Å at a glancing angle 9.6°. Calculate the wavelength of X-rays. (04 Marks)

Module-5

- 9 a. What are Shock waves? Explain the construction and working of Reddy Shock tube. (07 Marks)
- b. What are Nano materials? Explain the Sol-gel method of synthesis of nano materials. (06 Marks)
- c. Mention four applications of shock waves. (04 Marks)
- d. Calculate the wavelength of an electron accelerated under a potential difference of 100V in SEM. (03 Marks)

OR

- 10 a. Explain the principle, construction and working of Scanning Electron Microscope. (07 Marks)
- b. Define Carbon Nanotubes (CNTs). Discuss pyrolysis method of obtaining CNTs. (06 Marks)
- c. Mention three applications of CNTs. (03 Marks)
- d. Distinguish between Acoustic, Ultrasonic, Subsonic and Supersonic waves. (04 Marks)
