

**PART – A**

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

- Distinguish between spontaneous emission and stimulated emission.
- Find the numerical aperture of a glass clad fibre made with core glass of refractive index 1.5 and cladding is doped to give a fractional index difference of 0.0005.
- What are point defects? Describe Frenkel and Schottky defects.
- X-ray of wavelength  $1.75\text{\AA}$  are diffracted by (111) plane in a crystal at an angle  $30^\circ$  in the first order. Calculate inter atom spacing.
- Derive the expression for the de-Broglie wavelength of matter waves.
- Mention the main drawbacks of classical free electron theory of metals.
- Define drift and diffusion currents.
- Describe the origin of magnetic moments. Define Bohr magneton.
- Define the following terms in superconductors:
  - Critical temperature.
  - Critical magnetic field.
- What are carbon nanotubes? Mention the types of carbon nanotubes.

**PART – B**

(Answer all five units, 5 X 10 = 50 Marks)

**UNIT - I**

2 Derive the expression for brightness and darkness for a monochromatic light beam reflected from a thin parallel film of transparent material.

**OR**

- What is population inversion? How it is achieved by optical pumping?
- Explain the principle and working of ruby laser.

**UNIT - II**

- What do you understand by Miller indices of a crystal plane? Explain.
- Obtain an expression for the spacing between two consecutive parallel planes of miller indices (hkl) of cubic crystal of lattice parameter 'a'.

**OR**

5 What is piezoelectric effect? Explain the piezoelectric method of producing ultrasonic waves with neat circuit diagram

**UNIT - III**

6 Write the Schrodinger equation for a particle in a box. Solve it to obtain Eigen functions and show that the Eigen values are discrete.

**OR**

7 Discuss the Kronig-Penny model for the motion of an electron in a periodic potential. Show how the materials can be classified into conductors, insulators and semiconductors from E versus K graph.

**UNIT - IV**

8 What is Hall effect? Deduce the expression for Hall coefficient for p-type semiconductors and describe an experimental set up for measuring Hall voltage.

**OR**

9 Draw the B-H curve for a ferromagnetic material placed in a magnetic field and explain magnetic hysteresis on the basis of domain theory.

**UNIT - V**

- Discuss type-I and type-II superconductors.
- Discuss how BCS theory explains superconductivity.

**OR**

11 Classify the nanomaterials on the basis of dimensionality. Describe a method from each of top down and bottom up approaches of synthesis of nanomaterial.

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