**Code No: 121AD** **R15**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**B. Tech I Year Examinations, January/February - 2024**
**ENGINEERING PHYSICS**
**(Common to CE, EEE, ME, ECE, CSE, IT, AME, MIE, PTM)**

**Time: 3 Hours** **Max. Marks: 75**

**Note:** i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

## PART - A
**(25 Marks)**

| | | |
|---|---|---|
| 1.a) | What is packing fraction? | [2] |
| b) | How Miller Indices are useful to identify crystal planes in an FCC lattice? | [3] |
| c) | Describe the significance of Davisson and Germer's experiment in the context of quantum mechanics. | [2] |
| d) | What are matter waves? | [3] |
| e) | Define electric dipole moment. | [2] |
| f) | What is dielectric constant? | [3] |
| g) | Explain the characteristics of a laser. | [2] |
| h) | What is population inversion? | [3] |
| i) | Identify the factors affecting architectural acoustics. | [2] |
| j) | Explain Hall Effect. | [3] |

## PART - B
**(50 Marks)**

2.a) Given an X-ray diffraction angle (2θ) of 45° and an X-ray wavelength of 0.1 nm, use Bragg's Law to calculate the interplanar spacing in a crystal.
b) Describe the structure of a Sodium Chloride (NaCl) crystal. Discuss its bonding, coordination number. [5+5]

**OR**

3.a) Describe the Powder Method in X-ray diffraction and its advantages over the Laue Method.
b) Calculate the atomic packing factor for a Body-Centered Cubic (BCC) lattice, given that the atomic radius is 'r'. [5+5]

4.a) Explain the concept of 'Density of States' in the context of electron theory in solids and its significance in determining the electronic properties of materials.
b) How does the concept of Infinite Square well potential apply to quantum mechanics, and how is it extended to three dimensions? [5+5]

**OR**

5.a) Compare and contrast Bose-Einstein and Fermi-Dirac Statistics.
b) Explain the significance of the E-K curve and the origin of energy band formation in solids. [5+5]

6.a) Discuss the concept of internal fields in dielectric solids.
b) Describe the properties of anti-ferromagnetic and ferrimagnetic materials and their applications. [5+5]

**OR**

7.a) Compare and contrast electronic, ionic, and orientation polarizations in dielectrics.
b) Explain the domain theory of ferromagnetism and analyze the features of a hysteresis curve. [5+5]

8.a) Describe the diffraction grating experiment and its applications in measuring wavelengths of light.
b) Discuss Einstein's coefficients and their relation between them. [5+5]

**OR**

9.a) Discuss the theory of Fraunhofer diffraction due to a single slit and its significance.
b) Explain the concepts of acceptance angle and numerical aperture in fiber optics. [5+5]

10.a) Estimate carrier concentration in intrinsic semiconductors of conduction band.
b) Describe Sabine's formula for reverberation time and its application in acoustic design. [5+5]

**OR**

11.a) Discuss the I-V characteristics of a PN junction diode and its practical implications.
b) Compare and contrast the synthesis of nanomaterials using sol-gel and Chemical Vapor Deposition (CVD) techniques. [5+5]

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