

# C. U. SHAH UNIVERSITY

## Winter Examination-2021

Subject Name: Elements of Solid State Physics

Subject Code: 5SC03ESP1

Branch: M.Sc. (Physics)

Semester: 3

Date: 13/12/2021

Time: 02:30 To 05:30

Marks: 70

Instructions:

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
- (2) Instructions written on main answer book are strictly to be obeyed.
- (3) Draw neat diagrams and figures (if necessary) at right places.
- (4) Assume suitable data if needed.

### SECTION – I

- Q-1**      **Attempt the Following questions.**      **(07)**
- a) What is called Point defect?      **01**
  - b) What is F-centre?      **01**
  - c) Define dislocations.      **01**
  - d) Draw (211) miller indice.      **01**
  - e) Plot phonon dispersion curve for diatomic molecule.      **01**
  - f) Define: effective mass.      **01**
  - g) Define: Unit cell.      **01**
- Q-2**      **Attempt all questions**      **(14)**
- a) Describe the Bloch theorem.      **04**
  - b) If the energy required to create vacancy in a metal is 1 eV, calculate the ratio of vacancies in metal at 1000 K and 500 K.      **03**
  - c) Explain in brief Kroning Penny model.      **07**
- OR**
- Q-2**      **Attempt all questions**      **(14)**
- a) State and explain the Schrodinger wave equation.      **04**
  - b) Formula of nickel oxide with metal deficiency in its crystal is  $\text{Ni}_{0.98}\text{O}$ . The crystal contains  $\text{Ni}^{2+}$  and  $\text{Ni}^{3+}$  ions. Find the fraction of Nickel existing as  $\text{Ni}^{2+}$  ions in the crystal.      **03**
  - c) Derive an expression of dispersion relation of lattice vibrations in monoatomic lattices.      **07**
- Q-3**      **Attempt all questions**      **(14)**
- a) Explain Schottky and Frenkel defect in brief.      **07**
  - b) Explain: Reciprocal lattice of fcc.      **07**
- OR**
- Q-3**      a) Differentiate Conductor, Semi-conductor and insulator.      **05**



- b) A particle limited to the x-axis has the wave function  $\Psi = ax$  between  $x = 0$  and  $x = 1$ ; elsewhere. What is the probability that the particle can be found between  $x = 0.45$  and  $x = 0.55$ ? **03**
- c) Explain first Brillouin zone of sc lattice. **06**

### SECTION – II

**Q-4**                    **Attempt the Following questions.** **(07)**

- a) Give the examples of antiferromagnetism. **01**
- b) What do you mean by piezoelectricity? **01**
- c) What is the formula of Bohr magneton? **01**
- d) Define Electrical susceptibility. **01**
- e) What are the examples of polar molecules? **01**
- f) What is the formula of Larmor frequency? **01**
- g) Define: Domains. **01**

**Q-5**                    **Attempt all questions** **(14)**

- a) What is called polarization? Give its type. Explain in detail orientational polarization. **07**
- b) Explain the Weiss theory of ferromagnetism. **07**

**OR**

- Q-5**                    a) Explain Langevin's theory of diamagnetism. **07**
- b) State and explain Clausius-Mossotti relation in terms of dielectric and polarizability. **07**

**Q-6**                    **Attempt all questions** **(14)**

- a) Explain the Larmor precession phenomena of diamagnetic material. **05**
- b) The static dielectric constant of water is 8.1 and its refractive index is 1.33. Calculate the percentage contribution of ionic polarizability. **03**
- c) Explain: Hysteresis loop. **06**

**OR**

- Q-6**                    **Attempt all Questions**
- a) Explain in details Local electric field of an atom. **07**
- b) Explain Quantum theory of paramagnetism. **07**

