

Invigilator's Signature :

[Turn over



- iii) The term 'phonon' is related to
 - a) light wave
 - b) gas molecules
 - c) lattice vibration
 - d) positively charged ions.
- iv) Which of the following elements is added to iron to improve its corrosion resistance ?
 - a) Zn
 - b) Cr
 - c) Mg
 - d) Al.
- v) Curie-Weiss law is obeyed by
 - a) paramagnetic materials
 - b) ferromagnetic materials below Curie temperature
 - c) antiferromagnetic materials
 - d) ferromagnetic materials above Curie temperature.
- vi) At the equilibrium separation distance for an ion pair interionic force will be
 - a) zero
 - b) minimum
 - c) maximum
 - d) any value.
- vii) With the increase in temperature the orientation polarization in general
 - a) increases
 - b) decreases
 - c) remains constant
 - d) sharply increases.
- viii) Dislocations are sometimes called
 - a) point imperfection
 - b) line imperfection
 - c) surface imperfection
 - d) volume imperfection.
- ix) APF of regular HCP crystal structure is
 - a) 0.68
 - b) 0.74
 - c) 0.22
 - d) zero.
- x) A cation vacancy and an anion vacancy in a crystal of the type AB is called
 - a) Schottky defect
 - b) Frenkel defect
 - c) pair of vacancies
 - d) none of these.



GROUP - B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. What is meant by plastic behaviour of a material ? Explain with necessary stress-strain curve. What are engineering stress and engineering strain of a material ?
3. Define atomic packing factor. Prove that atomic packing factor for the FCC crystal structure is greater than the BCC crystal structure.
4. What is meant by polarization ? Explain different types of polarization mechanism involved in dielectric material.
5. What is creep ? Describe the mechanism of creep with a suitable graph.
6. State and explain Hume-Rothery rules of alloying. Hence explain the Cu-Ni solution.

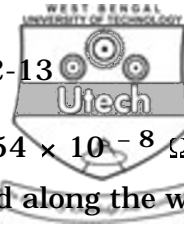
GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) What are ferroelectricity and piezoelectricity ? Give examples for ferroelectric and piezoelectric materials. $3 + 2$
- b) What is meant by local field in a solid dielectric ? Deduce an expression for the local field in a solid dielectric and hence obtain Clausius-Mosotti relation. $2 + 4$
- c) Calculate the electronic polarisability of an isolated Se atom. The atomic radius of a Se atom is 0.12 nm. 4
8. a) State some drawbacks of Drude-Lorentz theory.
- b) Explain why conductivity of a conductor decreases with temperature.
- c) If a copper wire of commercial purity is to conduct 10 A with a maximum voltage drop of 0.4 V/m, what would be its minimum diameter ?

Given : Conductivity = $5.85 \times 10^7 \Omega^{-1} \text{ m}^{-1}$.



- d) A uniform Ag-wire has a resistivity of $1.54 \times 10^{-8} \Omega\text{-m}$ at room temperature. For an electric field along the wire of 1 V/cm, compute the average drift velocity and mobility of electron.

Given : No. of electrons = $5.8 \times 10^{28} / \text{m}^3$,
 $e = 1.602 \times 10^{-19} \text{ C}$.

9. a) What are Schottky and Frenkel defects ? 2 + 2
- b) What do you mean by dislocation in the material ?
 Explain different types of dislocations that may be present in the material. 1 + 4
- c) With the help of a representative sketch explain briefly the salient points of the metastable iron-carbon equilibrium diagram. 6
10. a) Explain the solubility limits of Pb-Sn alloy from its phase diagram. What is the eutectic point for such an alloy ? 5 + 2
- b) Define the term APF of a crystal lattice. Calculate the APF of an HCP crystal.
 Given : $\frac{c}{a} = \sqrt{\frac{8}{3}}$. 5
- c) Explain why X-rays are used in determination of crystal structures. 3

