

Time: 3 Hours

JUNE 2013

Max. Marks: 100

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

Q.1 Choose the correct or the best alternative in the following: (2×10)

a. The $(1 \bar{1} 1)$ plane is parallel to

- (A) $(1 1 1)$ (B) $(\bar{1} 1 \bar{1})$
 (C) $(\bar{1} \bar{1} 1)$ (D) $(1 1 \bar{1})$

b. A cation vacancy and an anion vacancy in a crystal of type AB is called

- (A) Schottky defect (B) Frenkel defect
 (C) Pair of vacancies (D) None of these

c. At 0K, the probability of finding an electron at energy level E is unity, when

- (A) $E \ll E_F$ (B) $E \leq E_F$
 (C) $E > E_F$ (D) $E \gg E_F$

d. With the increase in temperature, the orientation polarization in general

- (A) increases (B) decreases
 (C) is constant (D) None of these

e. The temperature of the antiferromagnetic-to-paramagnetic transition is called

- (A) Antiferromagnetic Curie temp (B) Debye temp
 (C) Curie-Weiss temp (D) Neel temp

f. As compared to Si, the electron mobility in GaAs is

- (A) slower (B) same
 (C) faster (D) None of these

Code: AE58

Subject: MATERIALS & PROCESS

- g. The function of an oxide layer during IC fabrication is
- (A) to mask against diffusion or ion-implant
 - (B) to insulate the surface electrically
 - (C) to produce a chemically stable surface
 - (D) all of these
- h. For ideal Si P-N junction diode the forward cut-off voltage is
- (A) 0.7 Volt
 - (B) 0.3 Volt
 - (C) Zero Volt
 - (D) ∞ Volt
- i. As per Bragg's law
- (A) $\lambda = 2d \sin \theta$
 - (B) $\lambda = d \sin \theta$
 - (C) $n\lambda = \frac{d}{2} \sin \theta$
 - (D) $\lambda = 2d \cos \theta$
- j. Thermal expansion of materials arises from
- (A) strong bonds
 - (B) thermal vibrations
 - (C) weak bonds
 - (D) asymmetry of potential energy curve

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

- Q.2** a. Calculate the frequency & the wavelength of the radiation emitted, when an electron falls from the 2s level to the 1s level of the hydrogen atom. (8)
(energy of electron in hydrogen atom for 2s, $E = 2.18 \times 10^{-18}$ J and for 1s, $E = 5.44 \times 10^{-19}$ J)
- b. There is no end centered tetragonal lattice in the Bravais list, but there is an end-centred orthorhombic lattice. Explain why this is so. (8)
- Q.3** a. Calculate $\frac{c}{a}$ ratio for an ideally close packed HCP crystal. (8)
- b. What is a Burger Vector? Discuss the steps used to determine Burger Vector of dislocation. (8)
- Q.4** a. Explain the following:
- (i) Pipe diffusion
 - (ii) Lattice diffusion
- (4+4)

Code: AE58**Subject: MATERIALS & PROC**

- b. What is resistivity of conducting materials? Discuss the various factors which affects the resistivity. (8)
- Q.5** a. Explain the effect of dielectric on the behaviour of a capacitor. (8)
- b. Explain the following:
(i) Ferro-electricity (ii) Piezoelectricity (4+4)
- Q.6** a. Explain the following:
(i) Origin of permanent magnetic dipoles
(ii) Magnetic Resonance (4+4)
- b. The saturation of magnetization of BCC iron is 1750 kA/m. Calculate the net magnetic moment per iron atom in the crystal. (8)
- Q.7** a. The resistivity of pure silicon at room temperature is 3000 ohm-m. Calculate the intrinsic carrier density. (4)
- b. Explain the following:
(i) Types of semiconductors
(ii) Hall effect
(iii) Thermal conductivity of semiconductors (4+4+4)
- Q.8** a. Draw V-I characteristic of a P-N junction diode and explain the zener & avalanche breakdown. (8)
- b. Write applications of the following:
(i) Resistors
(ii) Paper capacitors
(iii) Air cored coils
(iv) Ferreed Relays (8)
- Q.9** Explain the following:
(i) Alloyed junction process.
(ii) Operation of JFET with high drain voltages. (2×8)