

**AMIETE – ET (Current & New Scheme )**

Time: 3 Hours

**December - 2017**

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 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
- The majority charge carriers in p-type Ge are
 

(A) free Electrons	(B) ions
(C) holes	(D) conduction electrons
- Hydrogen bonds are stronger than
 

(A) Van der waals bonds	(B) ionic bonds
(C) metallic bonds	(D) Covalent bonds
- The grown single crystal generally contains
 

(A) tilt boundaries	(B) dislocation loop due to vacancy condensation
(C) twin boundaries	(D) grain boundaries
- If the first reflection from a FCC crystal has a Bragg angle  $\theta$  of  $21.5^\circ$ , the second reflection will have an angle  $\theta$  of
 

(A) $18.5^\circ$	(B) $25^\circ$
(C) $31.2^\circ$	(D) $36.8^\circ$
- The following can be grown epitaxially on Si without creating significant distortion
 

(A) Si of a different doping	(B) $\text{SiO}_2$
(C) GaAs	(D) None of these
- The Fermi level is
 

(A) an average value of all available energy levels
(B) the highest occupied energy level at 0 K
(C) an energy level at the top of the valence band
(D) the largest available energy level.
- If P is the number of phases, F is the degree of freedom, and C is the number of components in a system, then according to phase rule
 

(A) $P + F = C - 2$	(B) $P + C = F - 2$
(C) $P + F = C + 2$	(D) $P + C = F + 2$

- i. Ionic polarization  
 (A) decreases with temperature  
 (B) increases with temperature  
 (C) may increase or decrease with temperature  
 (D) is independent of temperature
- j. The transition from the ferromagnetic to the paramagnetic state is named after  
 (A) Curie-Weiss (B) Curie  
 (C) Neel (D) Debye

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

- Q.2** a. Obtain the miller indices of a plane which intercepts at  $a$ ,  $b/2$ ,  $3c$  in a cubic unit cell. Draw a neat diagram showing the plane, where  $a$ ,  $b$ ,  $c$  are lattice parameters. (8)
- b. Explain the Powder Method and also give its advantages. (8)
- Q.3** a. Explain point imperfection in elemental crystals. (8)
- b. Explain the structure of silica and silicates. What is surface imperfection? (8)
- Q.4** a. What is current density in metals? How it depends on mobility of electrons? Calculate mobility of electrons in copper. (8)
- b. Explain the following: (4x2)  
 (i) Pipe diffusion (ii) Lattice diffusion
- Q.5** a. Derive expression for dielectric constant of monoatomic gasses. (8)
- b. What is piezoelectricity? What are different applications in which piezoelectricity is used. Describe materials that show piezoelectricity. (2+3+3)
- Q.6** a. In a 440 V, 50 Hz transformer, the total iron loss is 2300 W. When the applied voltage is 220 V at 25 Hz, the total iron losses are 750W. Calculate the eddy current loss at the normal voltage & frequency. (4)
- b. Explain the term anti-ferromagnetism. (4)
- c. Explain the significance of hysteresis. Sketch a neat representation of hysteresis loop for a –  
 (i) Transformer core. (ii) Strong electromagnet. (iii) Magnetic tape. (8)
- Q.7** a. What do understand by conductors, semi-conductors and insulators? Classify different types of semi-conductors. (8)
- b. The resistivity of pure silicon at room temperature is 3000 ohm-m. Calculate the intrinsic carrier density. (4)
- c. Derive an expression for Hall Voltage. (4)
- Q.8** a. Write short notes on, (i) Varactor diode (ii) Ferreed Relay (4x2)
- b. Write applications of the following:- (2x4)  
 (i) Carbon resistor (ii) Paper capacitor  
 (iii) Air cored inductor (iv) Thermal Relay
- Q.9** a. What is JFET? Explain the drain and transfer characteristics of JFET. (8)
- b. Write short notes on, (i) Grown junction (ii) Zone refining. (4x2)