

**AMIETE – ET (OLD SCHEME)**

Time: 3 Hours

**OCTOBER 2012**

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. A plane in a unit cell intersects x, y, z respectively at points whose distances from origin are  $1/3$ ,  $1/2$  and  $1/1$  units. Its miller indices are
- (A) (6 3 2) (B) (3 2 1)  
(C) (1 1 1) (D)  $(1/3) (1/2) (1/1)$
- b. Fick's first law of diffusion is applicable under
- (A) Steady state conditions of mass flow  
(B) Non-steady state conditions  
(C) Steady as well as non-steady state conditions  
(D) None of the above
- c. The maximum number of phases that can coexist in a single component system, at equilibrium is
- (A) 5 (B) 7  
(C) 3 (D) 2
- d. Which one of the following material does not have permanent magnetic dipoles?
- (A) Ferromagnetic (B) Antiferromagnetic  
(C) Paramagnetic (D) Diamagnetic
- e. Which one is the wrong anode-cathode combination?
- (A) Zinc-Iron (B) Silver-zinc  
(C) Iron-Tin (D) Nickel-Titanium

**Code: AE04****Subject: MATERIALS AND PROCESSES**

- f. The property of a material by which it can be drawn into wires is known as
- (A) Softness (B) Malleability  
(C) Ductility (D) Tempering
- g. In order to increase the mechanical strength of an aluminium conductor, one should go for
- (A) Doping (B) cold working  
(C) Heat treatment (D) steel reinforcement
- h. Magnetic susceptibility has the dimensions of
- (A) Wb-m (B) dimensionless  
(C) Wb/m<sup>2</sup> (D) Amp/m
- i. For a tunnel diode a decrease in current causes
- (A) Voltage constancy (B) decrease in voltage  
(C) Increase in voltage (D) none of the above
- j. Manganin is an alloy of
- (A) Manganese, Chromium, nickel (B) Manganese, aluminium, nickel  
(C) Copper, manganese, nickel (D) none of the above

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

- Q.2** a. Bonding in the intermetallic compound Ni<sub>3</sub>Al is predominantly metallic. Explain why there will be little, if any, ionic bonding component. The electronegativity of nickel is about 1.8. (4)
- b. How many electrons are present in the 3d energy level of an element having a valence of 2 with an atomic number of 27? (4)
- c. BCC lithium has a lattice parameter of  $3.5089 \times 10^{-8}$  cm and contains one vacancy per 200 unit cells. Calculate the number of vacancies per Cubic centimetre and the density of Li. (8)
- Q.3** a. Explain Gibbs phase rule and what does it indicate? Show that eutectoid reaction is non-variant. (8)
- b. The diffusion coefficient for Cr<sup>+3</sup> in Cr<sub>2</sub>O<sub>3</sub> is  $6 \times 10^{-15}$  cm<sup>2</sup>/s at 727°C and is  $1 \times 10^{-9}$  cm<sup>2</sup>/s at 1400°C. Calculate the activation energy and the constant D<sub>0</sub>. (8)

- Q.4** a. Find the conductivity of copper at 300 K, if the collision time for electron scattering in copper at 300 K is  $2 \times 10^{-14}$  sec. Given that density of copper =  $8960 \text{ kg/m}^3$ , atomic weight of copper = 63.54 amu and mass of an electron =  $9.1 \times 10^{-31} \text{ kg}$ . (8)
- b. Explain the effect of doping on the electrical conductivity of a semiconductor by giving a suitable example. The electrical conductivity of a semiconductor increases significantly on doping. Let us consider Ge at room temperature ( $\approx 300 \text{ K}$ ). Given that electron mobility ( $\mu_e$ ) and hole mobility ( $\mu_p$ ) are 0.38 and 0.18 respectively. (8)
- Q.5** a. State and explain Hall effect. What are its applications? (8)
- b. Define:  
(i) polarizability. (ii) dipole relaxation.  
(iii) loss angle. (iv) dielectric breakdown. (8)
- Q.6** a. What is mica? Write the chemical composition of two types of mica with its properties and uses. (8)
- b. Write the chemical composition of constantan, German silver, manganin, and nichrome along with their applications (8)
- Q.7** a. Describe the phenomenon of magnetic hysteresis and magnetization curve in a magnetic material. Also explain coercivity. (8)
- b. Explain why ferromagnetic materials can be permanently magnetized whereas paramagnetic ones cannot. (8)
- Q.8** a. Explain the process of fabrication of integrated circuits. (8)
- b. What is extrusion? Explain hot and cold extrusion. (8)
- Q.9** Write short notes on any **TWO**
- (i) Full annealing  
(ii) Hardening and tempering  
(iii) BURGER VECTOR (8×2)