

A 456

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2005.

Third Semester

Chemical Engineering

PH 232 — MATERIAL SCIENCE

(Common to Leather and Textile Technology)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. At atmospheric pressure a material of unknown composition shows four phases in equilibrium at 927 K. What is the minimum number of components in the system?
2. Why is the phase diagram for Fe-Fe₃C a metastable diagram?
3. What is fracture toughness?
4. Why are cold-worked materials avoided for high temperature applications?
5. Distinguish between Type I and Type II superconductors.
6. A conducting wire has a resistivity of $2.0 \times 10^{-8} \Omega\text{-m}$. An electric field of 150 V/m is applied parallel to the wire. If the density of conduction electrons is 6×10^{28} , calculate the drift velocity.
7. Define dielectric constant and electric polarization.
8. Write any two applications of ferroelectric materials.
9. Why is the electronic and lattice specific heat values of a conductor different?
10. How is step index fibre different from graded index fibre?

PART B — (5 × 16 = 80 marks)

11. (i) State and explain Gibbs phase rule. How is it used for studying the phase relationships for two components system? (8)
- (ii) Discuss the transformation of austenite when cooled at various cooling rates based on TTT diagram. (8)

12. (a) (i) Describe Griffiths crack model for purely brittle materials. (8)
- (ii) Draw the creep curve and explain various stages of creep. (8)

Or

- (b) (i) Explain viscoelastic properties of rubber. (8)
- (ii) Explain in detail the ductile–brittle transition. (8)
13. (a) (i) Explain the domain theory of ferromagnetic materials. (8)
- (ii) Discuss the fabrication, properties and uses of metallic glasses. (8)

Or

- (b) (i) Derive an expression relating electrical conductivity and relaxation time. (8)
- (ii) Describe the properties and uses of soft and hard magnetic materials. (8)
14. (a) (i) Describe different types of dielectric breakdown. (8)
- (ii) State the law of mass action for semiconductor and obtain an expression for it. (8)

Or

- (b) (i) Derive an expression for the Hall coefficient and explain an experiment to determine the same. (8)
- (ii) Discuss in detail the different types of polarization mechanism in dielectric materials. (8)

15. (a) (i) Derive Einstein's equation for the lattice specific heat of a solid and discuss its variation with temperature. (8)

(ii) Explain the principle and working of a nematic LCD. (8)

Or

(b) (i) Explain how light is propagated through optical fibre. (8)

(ii) How is a compound semiconductor different from an elemental semiconductor? What are its uses? Explain the working of an LED. (8)
