

**E 294**

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2003.

Third Semester

Chemical Engineering

(Common to Textile Technology and Leather Technology)

PH 232 — MATERIALS SCIENCE

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State and explain Gibb's phase rule.
2. What are metallic glasses? How are they formed?
3. What do you understand by creep? Explain different parts of a creep curve.
4. Explain fatigue fracture. Give any method for improving the fatigue life of a component.
5. Define "drift mobility" of free electrons in a conductor. Give the expression connecting 'mobility' and 'conductivity'.
6. What are ferromagnetic materials? Give one example.
7. Name one compound semiconductor and give its application.
8. Define 'polarisability' of a dielectric. Give the expression for orientational polarization induced by an electric field  $E$  at a temperature  $T$ .
9. State the assumptions of Einstein's theory of specific heat of solids.
10. Calculate the fibre acceptance angle for a step-index fibre with  $n_1 = 1.470$  and  $n_2 = 1.455$ .

PART B — (5 × 16 = 80 marks)

11. (i) Discuss Fe-Fe<sub>3</sub>C phase diagram. (8)  
(ii) How is 'zone refining' explained on the basis of phase diagrams? (8)
12. (a) (i) Explain ductile fracture. Indicate how this takes place in different types of materials. (6)  
(ii) What is meant by brittle fracture? Discuss Griffith's theory of brittle fracture. (10)

Or

- (b) (i) Explain clearly the two modes of plastic deformation. (6)  
(ii) Discuss how perfect and real crystals undergo plastic deformation by slip. (10)
13. (a) (i) Explain Meissner effect. Distinguish between Type-I and Type-II superconductors. (8)  
(ii) Discuss, in detail, any four applications of superconductors. (8)

Or

- (b) (i) Explain the hysteresis curve of a ferromagnetic material on the basis of domain theory. (8)  
(ii) Distinguish between soft and hard magnetic materials. Give one application of each. (8)
14. (a) (i) Explain Hall effect. Give the experimental method of determination of Hall coefficient. (12)  
(ii) Discuss applications of Hall effect. (4)

Or

- (b) (i) Explain dielectric breakdown. Define dielectric strength. Discuss mechanism of breakdown in gases. (10)  
(ii) Write notes on 'dielectric loss'. (6)

15. (a) (i) Discuss the physical principle and working of an LED. Draw its characteristic curve. (10)
- (ii) Explain briefly the application of fibre optics to an optical communication system. In what way it is superior to the conventional system? (6)

Or

- (b) (i) What are the limitations of Einstein's theory of sp.ht. of solids? How are these modified in Debye's theory? (4)
- (ii) On the basis of Debye's theory, derive an expression for the sp.ht. of solids. (12)