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B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2003.

Third Semester

Chemical Engineering

PH 232 — MATERIAL SCIENCE

(Common to Textile Chemistry, Textile Technology and Leather Technology)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1.   Why is the phase diagram for $Fe-Fe_3C$ a metastable phase diagram?

2.   Calculate the critical free energy of nucleation of ice from water at 0°C and −5°C. The enthalpy of fusion of ice of 6.02 J/mol. The energy of the ice–water interface 0.076 J/m^2 can be taken to be independent of temperature.

3.   Which material has high elastic modulus – transition metals or alkali metals? Why?

4.   What is ductile fracture?

5.   What is Meissner effect?

6.   Differentiate between dia and para magnetic materials.

7.   How does temperature variation affect the dielectric polarisation?

8.   Mention any two uses of ferroelectric materials.

9.   Calculate the wavelength of radiation emitted by GaAS LED having a band gap energy 1.45 eV.

10.   Define electronic specific heat and lattice specific heat.

PART B — (5 × 16 = 80 marks)

11.   (i)   Draw the Iron–Carbon phase diagram and explain its different region. (8)

      (ii)   Explain the rules for the formation of binary alloys.   (8)

12. (a) (i) Explain the Viscoelastic properties of rubber. (8)

(ii) Draw the stress – strain curve of a ductile material and explain different regions. (8)

Or

(b) (i) Explain different relaxation processes associated with the anelastic behaviour of a material. (8)

(ii) Discuss Griffth's theory on brittle fracture. (8)

13. (a) (i) Discuss the domain theory of ferromagnetic materials. (8)

(ii) Differentiate ferro, antiferro and ferri magnetic materials. (8)

Or

(b) (i) What are metallic glasses? Explain their fabrication processes and their properties. (8)

(ii) Discuss the properties and applications of Shape memory alloys. (8)

14. (a) (i) Discuss in detail the different types of polarisation mechanisms in dielectric materials. (8)

(ii) Explain different types of dielectric breakdown. (8)

Or

(b) (i) What are active and passive ferroelectric materials? Explain their properties. (8)

(ii) State the law of mass action for semiconductors and obtain an expression for it. (8)

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

(ii) Explain the working of an LED. (8)

Or

(b) (i) Distinguish between step index and graded index optical fibres. Explain how light is propagated through optical fibre. (10)

(ii) Explain the principle and working of an nematic LCD. (6)

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