Roll No. | | | | | | | | | | |

B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2013

Common to B.E.(Mechanical Engg., Industrial Engg., Manufacturing Engg., Mining Engg., Aeronautical Engg., Automobile Engg., & Production Engg.)

Semester II

PH8251-Materials Science

(Regulation 2012)

Time: 3 Hours | Answer ALL Questions | Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1. What is the role of dislocations in plastic deformation?
2. In the Brinell's test to measure hardness, a steel ball of diameter 25 cm is pressed on a material and a load of 5 kg is applied. If the indentation made on the surface is a circle of radius 10 cm, determine the hardness of the material.
3. Taking pressure variable into account, calculate the maximum number of phases that can co-exist in equilibrium in three and four component systems.
4. What are eutectic and peritectoid reactions?
5. State Fick's laws of diffusion in solids.
6. What is meant by laser hardening?
7. Why is that when the temperature is increased, conductivity of a conductor decreases while that of a semiconductor increases?
8. What are SQUIDs? What are their applications?
9. Compare the desired mechanical properties of a polymer matrix and fiber phases.
10. What are liquid crystals?

Part – B (5 x 16 = 80 marks)

11 (i) Describe an isomorphous binary phase diagram in detail and discuss about tie-line and lever rules. (12)

(ii) What are the microstructural changes during cooling? (4)

12. a) (i) Discuss in detail about various strengthening mechanisms. (12)

(ii) What is meant by creep? How to increase the creep resistance? (4)

OR

b) (i) With suitable diagrams, describe the Vicker's hardness method to determine the hardness of a material. (4)

(ii) Explain the Griffith's theory of fracture of brittle materials and obtain an expression for the fracture strength. What is the effect of plastic deformation on the fracture resistance? (12)

13. a) (i) Discuss in detail about the T-T-T diagram for eutectoid steels. (10)

(ii) Write a short note on alloying elements on the Fe-C system. (6)

OR

b). Describe the various heat treatment techniques employed to change the mechanical properties of steel.

14. a) (i) Derive the Langevin-Debye equation for the total polarization for a dielectric material. (12)

(ii) Show that the minimum conductivity for Si is obtained when it is p-type doped such that the hole concentration is

$$p_m = n_i\sqrt{\frac{\mu_e}{\mu_h}}$$ and the corresponding minimum conductivity is

$$\sigma_{min} = 2en_i\sqrt{\mu_e\mu_h}$$ (4)

OR

b) (i) Discuss in detail about the domain theory of ferromagnetic materials and based on that explain the hysteresis of such materials. (10)

(ii) Why are superconductors called as perfect diamagnets? Find the magnetic induction inside a superconductor which has a magnetic permeability of 1.5×10^{-3} Henry/m when a magnetic field of 1500 A/m^2 is applied. (4)

(iii) The critical field for niobium is 1×10^5 Amp/m at 8 K and 2×10^5 Amp/m at absolute zero. Find the transition temperature of the element. (2)

15. a) What are shape memory alloys? Explain their physical properties and discuss their applications. (2+6+8)

OR

b) (i) Write a short note on photoconducting polymers. (6)

(ii) Describe in detail about the properties and applications of biomaterials. (10)