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

MATERIALS SCIENCE AND ENGINEERING BRANCH

SECOND SEMESTER – (REGULATIONS 2012)

ML 8201 – STRUCTURE AND PROPERTIES OF MATERIALS

Time : 3 hrs

Max Marks: 100

18

Answer ALL Questions

Part – A (10 x 2 = 20 Marks)

1. What is the effect of movement of dislocations on mechanical properties of materials?
2. What are the miller indices of a plane in the cubic structure that intersects the x-axis at $\frac{1}{2}$ unit and y-axis at 1 unit and is perpendicular to xy plane. Draw the cubic structure and crosshatch the plane.
3. Explain the importance of equilibrium diagrams in the development of new alloys.
4. What are the limitations on the use of iron-iron carbide equilibrium diagram?
5. What factors determine the wear resisting properties of steel?
6. Sharp graphite flakes acts as stress raisers in grey cast iron. How this problem can be overcome?
7. Composite materials are replacing metallic materials nowadays. Why?
8. Name some specific applications of Boron carbide.
9. How does the degree of polymerization affect the crystallinity in polymers?
10. What are liquid crystal polymers?

Part – B (5 x 16 = 80 Marks)

11. a. (i) Calculate the equilibrium number of vacancies per cubic meter for gold at 900°C. The energy for vacancy formation is 0.98 eV / atom; the atomic weight and density for gold are 196.9 g /mol and 19.32 g/ cm³ respectively. [6]
(ii) What are the factors that govern the Solid solution formation in alloys? Explain. [10]
12. a. Two metals A & B have melting points 750° C and 500° C respectively. They form an eutectic at 75% B which melts at 400° C. Their solubilities at eutectic temperature are, 20%B in A and 10%A in B and at 0°C, 5% B in A and 10% A in B.

From the above information, draw the equilibrium diagram for the system clearly making all the phases present. From the diagram, determine what structures would be obtained in slowly cooled alloys of the following compositions 10%B, 40%B, 75%B and 95%B.

....2

(OR)

12. b. Draw the eutectoid, eutectic and peritectic portions of the iron-iron carbide phase diagram and explain the microstructural changes that occur during cooling for three different alloys.

13. a. Write the composition, properties and applications of the following alloys:

- i. Nickel silver
- ii. Austenitic stainless steel
- iii. Duralumin
- iv. Gunmetal

(OR)

13. b. (i) How are cast irons classified based on the fractured surface? [2]

(ii) Explain the method of manufacture of the different cast irons. [14]

14. a.(i) What are particulate composites? How does it differ from fibrous composites? [4]

(ii) Explain giving examples for the following particulate composites. [3x4=12]

- (i) Nonmetallic composites
- (ii) Metallic in nonmetallic composites
- (iii) Metallic in metallic composites

(OR)

14. b. Explain the following with respect to properties and applications.

- i SiAlON
- ii Carborandum
- iii Cermets
- iv Graphene

15.a. Explain the mechanism of Addition polymerization and condensation polymerization.

(OR)

15. b. Explain the following:

- i. Polyethylene
- ii. PTFE
- iii. Copolymers
- iv. Liquid crystal polymers