16

BE / B Tech (Full Time) DEGREE ARREAR EXAMINATIONS APRIL / MAY 2012

MATERIALS SCIENCE & ENGINEERING BRANCH

FIFTH SEMESTER

ML-9304 – Heat Treatment of Metals and Alloys

(REGULATIONS 2008)

Time : 3 hrs. Max. Mark : 100

Instructions : 1. Read questions carefully. Write 'to the point' answers
2. Question Nos. 1 to 11 are compulsory

Answer ALL Questions

Part – A (10 x 2 = 20 Marks)

1. What are the maximum solubility of Carbon in alpha-iron and gamma-iron?
2. Define hypo-eutectic cast iron.
3. Draw TTT-diagram with both pearlitic and bainitic bays.
4. Draw a cooling curve for which Austenite will transform to 50% Pearlite and 50% Martensite.
5. Name four industrially used quenching media.
6. What is Maraging steel?
7. Write down the basic principle of carburizing process.
8. Draw a representative eutectoid phase diagram.
9. What are the differences between white cast iron and grey cast iron?
10. Name four common defects observed in heat-treated steel.

Part – B (5 x 16 = 80 Marks)

11. (a) Draw Fe-C equilibrium phase diagram and mention all the temperatures and compositions of the relevant points clearly. Also point out various phase transformation reactions. (8)

    (b) Explain the microstructural changes on cooling from a temperature of 1000°C to room temperature for a 1.2% carbon-steel. Draw the respective microstructures. (8)

12. (a) Write short notes on the followings: (i) spheroidizing, (ii) stress relieving, (iii) sub-critical annealing and (iv) diffusion annealing. (4x4)

OR

(b) (i) What are the stages of annealing? Explain the stage-I annealing process in detail. (7)

(ii) Define recrystallization temperature. (2)

(iii) Name the factors that affect recrystallization temperature and explain the dependence on those process parameters. (2+5)

13. (a) (i) Discuss in detail the transformation mechanisms and kinetics of the following processes: (A) Pearlitic transformation, (B) Bainitic transformation, (C) Martensitic transformation. (16)

OR

(b) (i) Differentiate between hardness and hardenability. (2)

(ii) Name the factors that influence hardenability. Discuss the effects of these factors. (6)

(iii) Write short notes on: (A) Austempering and (B) Temper embrittlement. (8)

14. (a) (i) What are the characteristics of a quenchant? (3)

(ii) Write down the mechanism of heat removal during quenching. (7)

(iii) Write short notes on *any two* of the followings: (A) Salt bath furnaces, (B) Continuous furnaces, (C) Batch furnaces. (6)

OR

(b) (i) Write brief notes on: (A) Laser hardening, (B) Carbonitriding and (C) Boronizing. (9)

(ii) Discuss in detail the structural changes during tempering. (7)

15. (a) (i) Draw the microstructures and explain the important features of the followings: (A) Grey cast iron, (B) White cast iron, (C) Malleable cast iron, (D) Ductile cast iron. (8)

(ii) Discuss the malleabilization of white cast iron. (8)

OR

(b) (i) What is SG iron? how to obtain it? (2)

(ii) What are the various types of tool steels? Write short notes on *any two* of them. (8)

(iii) Write down the important facts about (A) Stainless steel and (B) Spring steel. (3+3)