VIT

Vellore Institute of Technology

SCHOOL OF MECHANICAL ENGINEERING

Continuous Assessment Test – II Fall Semester 2019-2020

Programme Name & Branch: B.Tech (Mechanical Engineering)

Course Name & Code: Materials Engineering and Technology (MEE1005)

Class Number: VL2019201001411/ VL2019201001836/ VL2019201001961

Slot: B2+TB2

Exam Duration: 90 mins

Maximum Marks: 50

Answer all questions

1. Two metals A (melting point 800°C) and B (melting point 600°C) form a binary isomorphous system. An alloy having 35% B has 75% solid and rest liquid whereas an alloy having 55% B has 25% solid at 700°C. Estimate the composition of solidus and liquidus at the above temperature. Apply phase rule to the two phase field of a binary isomorphous diagram. What conclusion can be drawn? [10]

2. The microstructure of a Pb-Sn alloy is shown in Figure 1. The dark constituent is the lead rich solid α and the light constituent is tin rich solid β. Specify the nature of alloy. The weight fraction of proeutectic phase is 0.21. Determine the composition of alloy. [10]

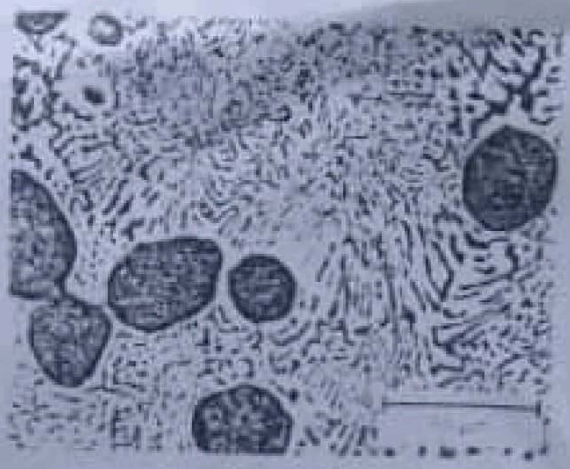

Figure 1

3. a) What is the carbon concentration of an iron-carbon alloy for which the fraction of total cementite is 0.10. Draw the microstructure of alloy at room temperature, 725°C and 900°C.

b) What is the fraction of proeutectoid and eutectoid phase for an iron-carbon alloy in which the mass fractions of total ferrite and total cementite are 0.86 and 0.14 respectively? What is the nature of alloy and its composition?

[5+5]

4. Draw the isothermal transformation diagram for an iron-carbon alloy of eutectoid composition. Sketch and label time-temperature paths on this diagram to produce the following microstructures. Also specify the time and temperature cycles required for each composition [10]

(a) 100% coarse pearlite

(b) 50% martensite and 50% austenite

(c) 50% coarse pearlite, 25% bainite, and 25% martensite

(d) 50% fine pearlite and 50% upper bainite

5. (a) Specify the heat treatment strategies for quenching of heavy steel casting of 0.4 wt% carbon with the help of transformation diagram.

(b) Which of the following transformation is possible with heat treatment techniques for a plain carbon steel with 0.45 wt% carbon? If possible gives the thermal cycles for the following transformations

(i) Pearlite to Martensite

(ii) Bainite to Pearlite

(iii) Martensite to Pearlite [5+5]