Question Paper

Exam Date & Time: 29-Apr-2019 (02:00 PM - 05:00 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES
IV SEMESTER B.Sc. (Applied Sciences) IN ENGINEERING END SEMESTER EXAMINATION APRIL/MAY 2019

Material Science and Metallurgy [ME 245]

Marks: 100 **Duration: 180 mins.**

Answer 5 out of 8 questions.

1) 1A) What are the various types of Crystal Imperfections? Explain with a neat sketch Ionic Defects. (10)

1B) Explain with neat sketch the mechanism of solidification. (10)

2) 2A) What is Unit Cell? What are the various types of crystal lattices? Explain briefly the effective number of atoms in cubic and HCP unit cells. (10)

2B) What is a solid solution? Explain the conditions favorable for the formation of solid solutions. (10)

3) 3A) Differentiate between homogeneous and heterogeneous nucleation. (10)

3B) With a neat sketch explain the construction procedure of simple binary phase diagram and explain the importance of phase diagram. (10)

4) 4A) The Al-Si system is assumed to be completely soluble in liquid state & insoluble in solid state. They from eutectic mixture at 580^{O}C, containing 10% Si, and The solidification temperature of pure metal Al & Si are 660 & 1440^{O}C respectively. (10)
Draw the phase diagram to a scale & assume lines are linear.
For 60% Si alloy draw cooling curve &det. The Following:-
i) Weight of Pro-eutectic phase.
ii) Weight ratio of two solids at Invariant reactions.

4B) Neatly sketch the Fe-Carbon phase diagram and label the regions. (10)

5) Explain with part of phase diagram and any two cooling curves Type II Eutectic Phase diagram. (10)

5A)

5B) With a part of phase diagram and cooling curves, explain the phase transformation of steel from austenite phase to room temperature phase. (10)

6) Explain three carburizing methods. (10)

6A)

6B) Enumerate any 6 differences between annealing and normalizing. (10)

7) Write the procedural steps of TTT diagram and neatly sketch the diagram for eutectoid steel. Superimpose the cooling path to obtain the lower bainitic structure. (10)

7A)

7B) What is Miller Indices? Sketch the following: (10)
(1 2 0) [2 4 6] (-1 3 5) (1 1 -1)

8) Breifly explain general properties of cast iron. (10)

8A)

8B) Explain with part of phase diagram and any two cooling curve Peritectic Phase diagram. (10)

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