Question Paper

Exam Date & Time: 20-Nov-2018 (02:00 PM - 05:00 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES
(Manipal Academy of Higher Education)
THIRD SEMESTER B.S. DEGREE EXAMINATION
NOVEMBER 2018
MECHANICAL ENGINEEERING
MATERIAL SCIENCE AND METALLURGY [IME 233]

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

C

Answer 5 out of 8 questions.

Answer ANY FIVE full Questions.
Missing data, if any, may be suitably assumed

1) A) What is co-ordination number? Explain the co-ordination number for BCC, FCC and HCP. (10)

B) What is Miller Index?. (10)

Sketch the following:

i. (2 0 1)

ii. [2 1 0]

iii. (1 1 1)

iv. $[1\ 1\ \bar{1}]$

v. (2 1 2)

2) A) What are dislocations? Explain with a neat sketch edge and screw dislocation with the help of Burger's Circuit. (10)

B) What is phase rule? Explain the application of phase rule for a single component system. (10)

3) A) Explain the conditions favorable for the formation of solid solutions. (10)

B) Differentiate between homogeneous and heterogeneous nucleation. (10)

4) Why degree of super cooling is necessary during (10)

A) solidification process?

B) Melting temperatures of metal A and metal B are 800^{o}C and 1200^{o}C respectively. Metal A and B are mutually soluble in the liquid state and partly soluble in the solid state. A liquid phase alloy containing approximately 30% B completely transforms into a mixture of two solid solutions at 600^{o}C. Maximum solubility of A in B and B in A are approximately 15% and 10% respectively at 600^{o}C, 10% and 5% respectively at 300^{o}C. Assuming the solubility curves to be linear, draw phase diagram to scale and label the regions. For 60% B alloy determine the following: (10)

- Weight percentage of the Eutectic mixture formed.
- Composition of the liquid phase for the reaction.

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

B) Neatly sketch the Fe-Carbon phase diagram and label the regions. On the diagram show any two alloys which solidifies like pure metal. (10)

6) A) With a part of phase diagram and cooling curves, explain the eutectoid phase transformation of steel. (10)

B) Neatly sketch TTT diagram and superimpose the cooling paths to obtain various structures. (10)

7) A) With heat treatment cycle, purposes and relevant sketches explain different types of annealing. (10)

B) Explain the following case hardening methods: (10)

- Carburizing
- Nitriding

8) A) With relevant sketches explain the standard hardenability test for eutectoid steel. (10)

B) Breifly explain general properties of grey and white cast iron. (10)

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