Question Paper

Exam Date & Time: 02-Jun-2018 (09:30 AM - 12:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES
IV SEMESTER B.Sc. DEGREE MAKE UP- EXAMINATION - MAY / JUNE 2018
DATE: 2 JUNE 2018
TIME : 9.30 AM TO 12.30 PM
Material Science and Metallurgy [ME 245]

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

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

1)		Derive Atomic packing factor for HCP unit cell.	(10)
	A)		
	B)	What is co-ordination number? Explain the co-ordination number for BCC. FCC, HCP?	(10)
2)		What are the various types of Crystal Imperfections? Explain with a neat sketch Ionic Defects	(10)
	A)		
	B)	Explain with neat sketch the mechanism of nucleation.	(10)
3)		Why degree of super cooling is necessary during solidification process? Explain the types of nucleation during solidification.	(10)
	A)		
	B)	Explain the conditions favorable for the formation of solid solutions.	(10)
4)		Two pure metals A & B with melting points 900^{o}C and	(10)
	A)	400^{o}C respectively are completely soluble in their molten state. Upon solidification the binary system gives rise to a single homogeneous solid. Details of start and end of solidification of various alloys in the series are as follows:	

Alloy of composition	Temperature (°C)	
	at start of solidification	at end of solidification
90%A-10%B	890	790
80%A-20%B	870	700
70%A-30%B	840	630
60%A-40%B	810	570
50%A-50%B	770	525
40%A-60%B	715	485
30%A-70%B	650	450
20%A-80%B	580	425
10%A-90%B	500	405

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

5) Melting temperatures of pure metals 'A' & 'B' are 1000^{o}C and 800^{o}C respectively. The metals 'A' and 'B' are mutually soluble in the liquid state and partly soluble in the solid state. A liquid phase alloy containing 40% A completely transforms into a mixture of two solid solutions at 600^{o}C. Maximum solubility of 'A' in 'B' and 'B' in 'A' are 10% and 20% respectively at 600^{o}C, 5% and 10% respectively at 0^{o}C. Assuming the curves to be linear, draw phase diagram to scale and label the regions. For 40% B alloy determine the following: (10)

A)
a) Weight percentage of eutectic formed at 400^{o}C.
b) Weight ratio of the solid phases in the eutectic mixture

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

6) Neatly sketch the Fe-Fe_3C phase diagram and label the regions. (10)

A)

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

7) Neatly sketch the TTT diagram for 0.8% Carbon steel. Superimpose 7 cooling path having different rates of cooling. (10)

A)

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

8) (10)

A) With heat treatment cycle, purposes and relevant sketches explain the following:

i) Hardening

ii) Tampering

B) Explain three carburizing methods. (10)

-----End-----