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10ME32A/AU32A/TL32

Third Semester B.E. Degree Examination, December 2012
Material Science and Metallurgy

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Define atomic packing factor and calculate atomic radius and packing factor for BCC structure. **(08 Marks)**

b. With a neat sketch, explain the line dislocation. **(06 Marks)**

c. State and explain the first Fick's law of diffusion. **(06 Marks)**

2 a. With the help of a neat schematic conventional stress-strain diagram for mild steel under tension, explain clearly the behaviour of the material till fracture. **(08 Marks)**

b. Explain non-linear elastic properties when a material is subjected to static tension. **(06 Marks)**

c. What is work hardening? Explain the reasons for the same. **(06 Marks)**

3 a. Explain with neat figure ductile fracture using both stress-strain and stages of fracture. **(08 Marks)**

b. What is mean by stress relaxation? Explain with figure. **(06 Marks)**

c. With the help of sketch, discuss the different types of stress cycles which bring about fatigue failure. **(06 Marks)**

4 a. Explain with neat sketches the different stages of mechanisms of solidification. **(08 Marks)**

b. Define solid solution. Explain the substitutional and interstitial solid solution. **(08 Marks)**

c. Explain the factors governing the formation of substitutional solid solutions. **(04 Marks)**

PART – B

5 a. Draw and explain the Iron - Iron carbide equilibrium diagram and label all the points and fields. **(10 Marks)**

b. Construct a phase diagram using the following data and label all the fields:

Melting point of Ag = 961°C	Melting point of Cu = 1083°C
Eutectic temperature = 780°C	Eutectic composition = 28% Cu.
Max. solubility of Cu in Ag = 9% at 780°C	Max. solubility of Cu in Ag = 2% at 0°C
Max. solubility of Cu in Ag = 9% at 780°C	Max. solubility of Cu in Ag = 0% at 0°C

Determine the following:

i) Solidification start and end of temperature for 30% Ag alloy.

ii) Temperature at which a 15% Cu alloy has 50% liquid phase and 50% solid phase.

iii) Percentage composition of liquid and solid phase in 20% Ag alloy at 900°C. **(10 Marks)**

6 a. Draw the TTT diagram of austenite for eutectoid steel. Explain the various transformations product of austenite. **(08 Marks)**

b. Discuss the process temperature range, microstructure of products and applications of stress relief annealing. **(06 Marks)**

c. Explain with neat sketch induction hardening process. **(06 Marks)**

7 a. Give the composition, structure and their applications of
i) S.G. Iron ii) Malleable Iron iii) Gray cast iron. **(08 Marks)**

b. Name at least four important copper base alloys. Give composition microstructure and their applications. **(08 Marks)**

c. Write a note on Al-Si alloys. **(04 Marks)**

8 a. Explain the term composite materials with examples. State their advantages and limitations of composites in practice. **(08 Marks)**

b. Using neat sketch, explain the process of preparation of metal matrix composite using melting and casting method. **(08 Marks)**

c. What are FRPs? Give at least four examples. **(04 Marks)**

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