Roll No. | | | | | | | | | | |

6

B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2013

MECHANICAL ENGINEERING BRANCH

IV Semester

ME9252 Engineering Materials and Metallurgy

(R2008)

Time: 3 Hours | Answer ALL Questions | Max. Marks 100

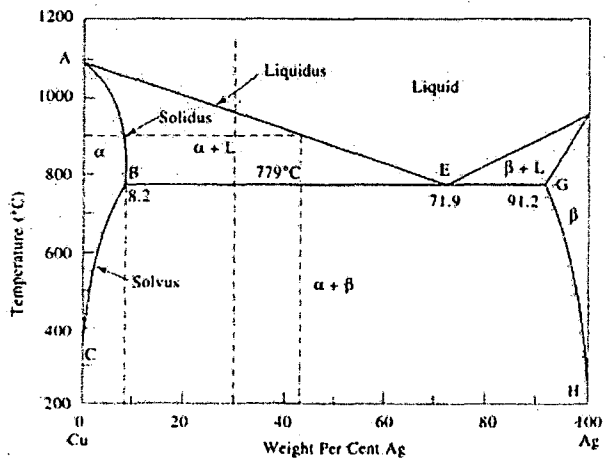
PART-A (10 x 2 = 20 Marks)

1. State the Hume-Rothery's rules for alloy formation
2. Aluminium alloys are rapidly cooled. True or False? Justify your answer
3. What are diffusion dependent transformation and diffusionless transformation?
4. Carburizing can be done on high carbon steel. True or False. Justify your answer
5. What are the major elements in Nimonics?
6. What does AZ91 refer to?
7. The relatively large elastic deformation encountered in case of rubbery or elastomeric materials is due to stretching of atomic bonds. Is this statement correct? Justify your answer
8. Ceramics are strengthened by the addition of fibers. Is it True or False? Justify your answer
9. Distinguish between transgranular fracture and intergranular fracture.
10. The strength of the material is increased on decreasing the grain size. Is it True or False? Justify your answer

Part – B (5 x 16 = 80 marks)

11 (i) Construct the phase diagram for the binary alloys from the cooling diagrams (6)

(ii) The alloy phase diagram of Cu-Ag system is given in fig. An alloy of Cu-30 wt% Ag is cooled slowly from 1200°C. From the data given in the phase diagram calculate the following: (i) The amount of liquid and proeutectic α at 900°C, (ii) the amount of Proectectic α and liquid formed just before the eutectic reaction (iii) the amount of α and β formed at 600°C. (10)



12a	(i)	What is case hardening? Explain different types of carburizing	(12)
	(ii)	At approximately what temperature would a specimen of Fe alloy has to be carburized for 4hrs to produce the same diffusion results as at 1000°C for 12 hrs. given D_0 and Q for diffusion of C in Fe $1x10^{-5}$ m^2/s and 32.4 kcal/mol	(4)
		OR	
12b	(i)	Explain Martempering process with TTT diagram	(8)
	(ii)	Define Hardenability and explain the procedure to conduct Jominy End Quench Test	(8)
13a	(i)	How to designate Aluminium alloys and list out the aluminium alloys based on its designation	(8)
	(ii)	Explain the properties and applications of (a) Brass (b) Bronze	(8)
		OR	
13b	(i)	Explain the effects of different alloying elements with steel	(10)
	(ii)	list out the applications of following alloys (a) Bainitic steel (2) Invar (3) HSLA Steels	(6)
14a	(i)	A continuous fiber reinforced epoxy based composite is to be developed containing 30 volume fraction of fibers. The minimum longitudinal modulus of elasticity and tensile strength of the composite must be $5.5x10^4$ and 1000MPa respectively. Among glass, carbon and agamid fibers, which are possible candidates and why? Modulus of elasticity of Epoxy=$3.1x10^3$ MPa and Tensile strength is equal to 69MPa. For Glass fiber E_f=$72x10^3$ MPa and Tensile strength=$3.5x10^3$ MPa. For Carbon fiber, E_f=$325x10^3$ MPa and Tensile strength=$4x10^3$ MPa. For aramid fibers, E_f=$124x10^3$ MPa and Tensile strength=$3.5x10^3$ MPa	(8)
	(ii)	Explain the properties and applications of (a) PE (b) HDPE (c) PMMA (d) PVC	(8)
		OR	
14b	(i)	Explain different types of composites and also discuss the strengthening mechanism of particle reinforced composites	(8)
	(ii)	Classify the nanomaterials based on its dimensionality	(8)
15a	(i)	Compare the engineering stress and strain with the true stress and strain for the tensile test of a low carbon steel that has the following test values Load applied to specimen=75 KN Initial specimen diameter =12.5mm Diameter of the specimen under 75KN load=12 mm	(8)
	(ii)	Explain Creep deformation Mechanism	(8)
		OR	
15b	(i)	Explain the mechanism of fatigue failure and also explain the methods to improve the fatigue strength	(8)
	(ii)	Explain different strengthening mechanisms	(8)