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

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, APR / MAY 2025

B.E. MANUFACTURING ENGINEERING
Semester IV

MF23304 - ENGINEERING MATERIALS AND METALLURGY

(Regulation 2023)

Time: 3 hrs | Max. Marks: 100

CO1	Construct the iron-iron carbide phase diagram and estimate the phases present in the microstructure.
CO2	Select a suitable heat treatment process for ferrous alloys based on the requirements.
CO3	Choose suitable ferrous and non-ferrous alloys for specific engineering applications
CO4	Use different polymer, ceramics and composites for a specific engineering applications
CO5	Describe testing procedures and failure mechanisms

BL – Bloom's Taxonomy Levels
(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A (10 x 2 = 20 Marks)
(Answer all Questions)

Q.No	Questions	Marks	CO	BL
1	How does electronegativity affect the formation of a substitutional solid solution according to the Hume-Rothery rules?	2	1	L2
2	In a Pb-Sn alloy at a specific temperature, the overall composition is 60% Pb and 40% Sn by weight. If the solid phase contains 90% Pb and 10% Sn, and the liquid phase contains 40% Pb and 60% Sn, calculate the mass fraction of the solid phase.	2	1	L2
3	Why normalized components are have better mechanical properties than annealed components?	2	2	L2
4	How high toughness is achieved in austempering than martempering?	2	2	L3
5	Why is molybdenum considered an important ferritic stabilizer in alloy steels?	2	3	L2
6	What are magnesium alloys? Why do they have poor corrosion resistance?	2	3	L2
7	List any two functions of matrix and reinforcement in composites.	2	4	L1
8	What are intermetallic compounds, and how do they differ from solid solutions?	2	4	L2
9	Sketch stress-strain curve and name any four terms.	2	5	L2
10	What are fatigue and creep behaviours of a material?	2	5	L2

PART- B (5 x 13 = 65 Marks)

Q.No	Questions	Marks	CO	BL
11 (a)	Draw the iron-carbon phase diagram and identify critical points like eutectic, eutectoid, and peritectic reactions. Explain the significance of each point with composition and temperature.	13	1	L3
	OR			

11 (b)	Classify steels based on their carbon content and cast irons based on their microstructure. For each type, explain their mechanical properties and appropriate applications for each classification.	**13**	1	L3
12 (a)	Enumerate the different types of annealing processes with its salient features and advantages.	**13**	2	L3
	OR			
12 (b)	What is case hardening? Compile the various case hardening process and its types involved in it.	**13**	2	L3
13 (a)	Compile the applications of copper and its alloys with their properties and applications.	13	3	L3
	OR			
13 (b)	Discuss the properties and applications of titanium and nickel based alloys.	**13**	3	L3
14 (a)	Classify the different types of polymers. Explain in detail about their basis of classification, properties and applications.	**13**	4	L2
	OR			
14 (b)	Explain the properties and applications of engineering ceramics.	**13**	4	L2
15 (a) i)	Enumerate the mechanism of plastic deformation.	**8**	5	L3
ii)	Compare and contrast brittle and ductile fracture.	**5**	5	L3
	OR			
15 (b) i)	With neat schematic relate and explain the procedure involved in Rockwell hardness test.	**7**	5	L3
ii)	Identify how specimen orientation, notch geometry in Charpy and Izod tests on aluminium affects the energy absorption.	**6**	5	L3

PART- C (1 x 15 = 15 Marks)

(Q.No.16 is compulsory)

Q.No	Questions	Marks	CO	BL
16. i)	Design a heat treatment cycle for a eutectoid steel using CCT diagram to achieve a fine pearlitic microstructure.	**7**	2	L5
ii)	Design an optimized heat treatment cycle for aluminium alloy containing 5% of copper to maximize its yield strength and ductility for aerospace structures applications.	**8**	3	L5