RollNo. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

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

Materials Science and Engineering
Semester IV
MS23402 & CASTING AND WELDING METALLURGY
(Regulation2023)

Time:3hrs Max.Marks: 100

CO1	Select suitable casting process for application requirement and demonstrate the sand casting and fabrication of complex welded structures
CO2	Apply gating design and mould design knowledge to overcome defects in casting and determine the various properties of moulding sand
CO3	Select suitable welding process according to the requirements and apply metallurgical aspects of welding to overcome defects in welding and analyse the effect of welding parameters on bead geometry, the grain size and hardness
CO4	Discuss on the physical metallurgy of welding and the interpret the phase transformations in the different zones of welding
CO5	Explain the weldability of alloy steels and non-ferrous materials

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

PART- A(10x2=20Marks)
(Answer all Questions)

Q.No.	Questions	Marks	CO	BL
1	Write a short on Niyama Criterion	2	1	1
2	Write a short note on Austempered Ductile Iron	2	1	1
3	List the application of Aluminium castings	2	2	1
4	Write the roles of chills in Casting	2	2	2
5	Write the formula for calculating Heat input in Arc welding process.	2	3	2
6	Write the differences between MIG and TIG welding processes	2	3	2
7	State the carbon equivalent (CE) formula used to evaluate the weldability of low carbon steels	2	4	1
8	Define the eutectoid reaction in the context of phase transformations in alloys	2	4	1
9	Define sensitization.	2	5	1
10	List the problems encountered while joining Titanium alloys.	2	5	2

PART- B(5x 13=65Marks)
(Restrict to a maximum of 2 subdivisions)

Q.No.	Questions	Marks	CO	BL
11 (a)	Derive the critical radius for stable nucleus in solidification and analyze the differences in solidification behavior between metals and alloys, highlighting the factors that influence their solidification process	13	1	3
	OR			
11 (b)	Describe how alloying elements such as Silicon, Manganese, Nickel, Molybdenum, and Cobalt are used in steels and explain their impact on the material's properties.	13	1	3

12 (a)	Analyze the melting practices of Nickel-based and Magnesium alloys, and examine the casting challenges specific to these alloy systems.	13	2	4
	OR			
12 (b)	Analyze the various types of casting defects that occur in the sand casting process by identifying their causes and suggesting appropriate corrective measures.	13	2	4
13 (a)	Explain the thermal cycle experienced at a point in the heat-affected zone (HAZ) near the interface during Laser and MIG welding processes, and apply your understanding to highlight their differences	13	3	3
	OR			
13 (b)	Explain how preheat treatment, joint geometry, and thermal conductivity influence the thermal cycle during welding, and apply your understanding to predict their effects on heating rate, cooling rates and weld properties.	13	3	3
14 (a)	Apply your knowledge of microstructural transformations in weld metals to explain the formation mechanism of acicular ferrite. Analyze how its presence influences the toughness of welded joints.	13	4	3
	OR			
14 (b)	Apply your understanding of welding metallurgy to analyze a scenario where cold cracking occurs in a welded joint. Explain the mechanism of cold crack formation in this context, identify possible causes, and propose appropriate preventive measures.	13	4	3
15 (a)	Apply your understanding of welding solidification processes to explain how solidification cracks form in welds. Analyze the contributing factors and recommend practical measures to prevent their occurrence.	13	5	3
	OR			
15 (b)	Apply your knowledge of aluminium's physical, mechanical, and chemical properties to evaluate its weldability. Identify the major challenges encountered during welding of aluminium, explain the reasons behind them, and suggest practical solutions	13	5	3

PART- C(1x 15=15Marks)

(Q.No.16 is compulsory)

Q.No.	Questions	Marks	CO	BL
16.	Develop a comprehensive welding procedure specification (WPS) for performing MIG welding on similar metals used in any specific applications. Justify your selection of welding parameters, shielding gas, filler material, and post-weld treatments based on metallurgical considerations."	15	3	6

ADDITIONAL CONTROLLER OF EXAMINATIONS ★ CHENNAI 600 025 AU