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ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

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

B.E MATERIALS SCIENCE AND ENGINEERING

SEMESTER – V

ML5503 CASTING METALLURGY

(Regulation2019)

Time:3hrs Max.Marks: 100

CO1	Should be able to select a proper material for making a pattern, design patterns, and decide on the composition of sand and core and know about the different furnaces for available for melting metals.
CO2	Will be able to understand the various casting processes available for casting a component.
CO3	Will be able to design suitable gating system for casting a component.
CO4	Will be able to cast ferrous castings which are metallurgically sound.
CO5	Will be able to cast nonferrous castings which are metallurgically sound.

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	List any four types of patterns used in foundry practice.	2	1	2
2	Name four chemical additives mixed with moulding sand along with its purpose.	2	1	2
3	Distinguish between: Investment Casting and Pressure Die Casting.	2	2	2
4	What is the CO_2 process in moulding?	2	2	2
5	State Chvorinov's Rule.	2	3	2
6	Name any four software tools assist in casting solidification analysis.	2	3	2
7	Distinguish between: Ferritic and Austenitic Stainless Steels	2	4	2
8	Write the eutectic composition of grey cast iron.	2	4	2
9	List out the role of residual stresses in casting failures.	2	5	2
10	**Match the following:**	2	5	2

(Alloy/Concept)	(Description/Use)
1.Al-Si Alloy	A.Used in high-temperature applications
2.Nickel-Based Alloys	B.Good castability, used in die casting
3.Zinc Alloys	C.Removes hydrogen from molten metal
4.Degassing Techniques	D.Requires modification with Na or Sr

PART- B(5x 13=65Marks)

Q.No	Questions	Marks	CO	BL
11 (a)	Illustrate the working of a Cupola furnace with a neat sketch and explain each zone's function.	13	1	3
	OR			
11 (b)	Discuss the common defects in castings along with its reasons as well as a representative sketch for each defect. Also provide the preventive measures.	13	1	3
12 (a)	Explain the step-by-step procedure of Investment Casting with diagrams.	13	2	4
	OR			
12 (b)	Analyze the process parameters that influence the quality of high-pressure moulding techniques such as Jolt Squeeze *and* High-Pressure Moulding Machines.	13	2	4
13 (a)	Using a step-by-step approach, calculate the number of risers needed for a casting of known volume and cooling characteristics.	13	3	3
	OR			
13 (b)	Compare and contrast different riser design methods: Caine's method vs. Naval Research Laboratory approach.	13	3	3
14 (a)	Describe the solidification of eutectic alloys and compare it with the solidification of pure metals.	13	4	4
	OR			
14 (b)	Assess the effect of normal and alloying elements on the mechanical properties and microstructure of steels using phase diagrams and composition ranges.	13	4	4
15 (a)	Explain the grain refinement and modification process in Al-Si alloys. Include the role of titanium and strontium.	13	5	4
	OR			
15 (b)	Describe the steps involved in the heat treatment of aluminium alloys including solutionizing, quenching, and aging.	13	5	4

PART- C(1x 15=15Marks)

Q. No	Questions	Marks	CO	BL
16.	**Design** a complete casting layout and melting procedure for producing a **stainless steel valve body**. Your design should include: i. Gating and riser system (with justification), ii. Solidification strategy for minimizing shrinkage and segregation, iii. Choice of alloying elements, iv. Slag-metal reaction control methods, v. Use of computer simulation software (e.g., ProCAST, MAGMASOFT) for verifying your design.	15	3	5