

MOHAMMED SATHAK A J COLLEGE OF ENGINEERING							
Siruseri IT Park, OMR, Chennai - 603103.							
LESSON PLAN							
Department of Mechanical Engineering							
Name of the Subject	Casting and Welding Processes			Name of the handling Faculty	Mr.Rajesh J		
Subject Code	CME395			Year / Sem	III/V		
Acad Year	2023-2024			Batch	2021-2025		
Course Objective							
1. To study the ferrous casting metallurgy and its applications.							
2. To study the nonferrous casting metallurgy and its applications.							
3. To study the ferrous welding metallurgy and its applications.							
4. To study the welding metallurgy of alloy steels and nonferrous metals and its applications							
5. To Identifying the causes and remedies of various welding defects; applying welding standards and codes.							
Course Outcome							
CO1. Explain the ferrous casting metallurgy and its applications.							
CO2. Explain the non ferrous casting metallurgy and its applications.							
CO3. Explain the ferrous welding metallurgy and its applications.							
CO4. Explain the welding metallurgy of alloy steels and non ferrous metals and its applications.							
CO5. Identify the causes and remedies of various welding defects; apply welding standards and codes.							
Lesson Plan							
Sl. No.	Topic(s)	T / R*	Periods Required	Mode of Teaching (BB / PPT / NPTEL /	Blooms Level (L1-L6)	CO	PO
		Book					
UNIT I FERROUS CAST ALLOYS							
1	Solidification of pure metals and alloys and eutectics - Nucleation - Growth Process	T1	1	BB	L1	CO1	PO1 & PO2
2	Critical nucleus size- Super cooling- Niyama Criterion -G/R ratio	T1	1	BB	L1	CO1	PO1 & PO2
3	Cell- Dendritic - Random dendritic structure- Segregation and Coring	T1	1	BB	L1	CO1	PO1 & PO2
4	Eutectics-Compositions and alloys in Cast Irons, FG-CGI- SG structures,	T1	1	BB	L2	CO1	PO1 & PO2
5	Metallic Glass- Mold dilation, Mold metal reactions- Structure and Section sensitivity	T1	1	BB	L1	CO1	PO1 & PO2
6	Cast irons- family & microstructures-Alloying effects-Malleable Iron, ADI, Charge calculations	T1	1	BB	L2	CO1	PO1 & PO2
7	Effect of normal elements and alloying elements in steels, Compositional aspects and properties of alloy steels	T1	1	BB	L2	CO1	PO1 & PO2
8	melting procedure and composition control for carbon steels- low alloy steels - stainless steels	T1	1	BB	L3	CO1	PO1 & PO2
9	composition control- slag-metal reactions- desulphurization- dephosphorization, specifications for carbon steels- low alloy steels and stainless steels	T1	1	BB	L3	CO1	PO1 & PO2

<b>Suggested Activity:</b> Assignment							
<b>Evaluation method:</b> Evaluation of Assignment							
<b>UNIT II NON-FERROUS CAST ALLOYS</b>							
10	Copper , Aluminium base alloys	T1	1	BB	L2	CO2	PO1 & PO2
11	Magnesium, zinc, Nickel base alloys	T1	1	BB	L2	CO2	PO1 & PO2
12	Melting practices - Al alloys, Mg alloys, Nickel alloys,	T1	1	BB	L3	CO2	PO1 & PO2
13	Melting practices - Zinc alloys and copper alloys	T1	1	BB	L3	CO2	PO1 & PO2
14	modification and grain refinement of Al alloys	T1	1	BB	L2	CO2	PO1 & PO2
15	problems in composition control- degassing techniques	T1	1	BB	L2	CO2	PO1 & PO2
16	Heat Treatment of Aluminium alloys – Basics of Solution and Precipitation process.	T1	1	BB	L2	CO2	PO1 & PO2
17	Applications of Aluminium Alloy castings in various fields.	T1	1	BB	L2	CO2	PO1 & PO2
18	Residual Stresses- defects in castings.	T1	1	BB	L3	CO2	PO1 & PO2
<b>Suggested Activity:</b> Seminar							
<b>Evaluation method:</b> Evaluation of Seminar							
<b>UNIT III PHYSICAL METALLURGY OF WELDING</b>							
19	Welding of ferrous materials: Iron- Iron carbide diagram	T1	1	BB / NPTEL	L2	CO3	PO1 & PO2
20	TTT and CCT diagrams	T1	1	BB	L2	CO3	PO1 & PO2
21	Effects of steel composition	T1	1	BB	L2	CO3	PO1 & PO2
22	formation of different microstructural zones in welded plain-carbon steels	T1	1	BB / NPTEL	L3	CO3	PO1 & PO2
23	Welding of C-Mn and low-alloy steels	T1	1	BB	L3	CO3	PO1 & PO2
24	phase transformations in weld and heat - affected zones	T1	1	BB	L2	CO3	PO1 & PO2
25	cold cracking, role of hydrogen and carbon equivalent	T1	1	BB	L2	CO3	PO1 & PO2
26	formation of acicular ferrite	T1	1	BB	L1	CO3	PO1 & PO2
27	effect on weld metal toughness.	T1	1	BB	L1	CO3	PO1 & PO2
<b>Suggested Activity:</b> MCQ given							
<b>Evaluation method:</b> Evaluation of MCQ.							
<b>UNIT IV WELDING OF ALLOY STEELS AND NON-FERROUS METALS</b>							
28	Welding of stainless steels, types of stainless steels	T2	1	BB / NPTEL	L1	CO4	PO1 & PO2
29	overview of joining ferritic and martensitic types	T2	1	BB	L2	CO4	PO1 & PO2
30	welding of austenitic stainless steels	T2	1	BB / NPTEL	L2	CO4	PO1 & PO2
31	Sensitisation, hot cracking	T2	1	BB	L2	CO4	PO1 & PO2
32	sigma phase and chromium carbide formation, ways of overcoming these difficulties	T2	1	BB	L2	CO4	PO1 & PO2

33	welding of cast iron	T2	1	BB	L3	CO4	PO1 & PO2
34	Welding of non-ferrous materials: Joining of aluminium, copper, problems encountered and solutions	T2	1	BB / NPTEL	L3	CO4	PO1 & PO2
35	Welding of non-ferrous materials: Joining of nickel , problems encountered and solutions	T2	1	BB / NPTEL	L3	CO4	PO1 & PO2
36	Welding of non-ferrous materials: Joining of titanium alloys, problems encountered and solutions	T2	1	BB / NPTEL	L3	CO4	PO1 & PO2

**Suggested Activity:** Assignment given

**Evaluation method:** Evaluation of Assignment.

#### UNIT V DEFECTS, WELDABILITY AND STANDARDS

37	Defects in welded joints	T2	1	BB	L1	CO5	PO1 & PO2
38	Defects such as arc strike, porosity - causes and remedies in each case	T2	1	BB	L2	CO5	PO1 & PO2
39	Defects such as undercut, slag entrapment - causes and remedies in each case	T2	1	BB	L2	CO5	PO1 & PO2
40	Hot cracking, causes and remedy	T2	1	BB	L2	CO5	PO1 & PO2
41	Joining of dissimilar materials	T2	1	BB / NPTEL	L2	CO5	PO1 & PO2
42	weldability of weldments	T2	1	BB / NPTEL	L1	CO5	PO1 & PO2
43	Testing of weldments	T2	1	BB	L1	CO5	PO1 & PO2
44	Testing of weldments	T2	1	BB	L3	CO5	PO1 & PO2
45	Introduction to International Standards and Codes	T2	1	BB	L1	CO5	PO1 & PO2

**Suggested Activity: Quiz**

**Evaluation method:** Evaluation of Quiz.

#### Content Beyond the Syllabus Planned

1	Introduction to Gleeble 2.0
2	Introduction to Composites

#### Text Books

1	Heine R W, Loper C R and Rosenthal P C, "Principles of Metal Castings", Tata McGraw Hill, 2017.
2	A.K.Chakrabarthy, 'Casting Technology and Cast Alloys, Prentice Hall, 2005.

#### Reference Books

1	ASM International. Handbook Committee, ASM Handbook: Casting. Volume T5, ASM International, 2008.
2	Baldev Raj, Shankar V, Bhaduri A K, "Welding Technology for Engineers", Narosa Publications, 2009.
3	Beeley P, "Foundry Technology" Butterworth-Heinemann, 2001.
4	R.S.Parmar, 'Welding Engineering and Technology', Khanna Publishers, 2010
5	John Campbell, "Casting", Butterworth-Heinemann, 2003.

#### Website / URL References

1	<a href="https://archive.nptel.ac.in/courses/113/107/113107092/">https://archive.nptel.ac.in/courses/113/107/113107092/</a>
2	<a href="https://archive.nptel.ac.in/courses/112/107/112107215/">https://archive.nptel.ac.in/courses/112/107/112107215/</a>

#### Blooms Level

Level 1 (L1) : Remembering					Lower Order Thinking	Fixed Hour Exams	Level 4 (L4) : Analysing						Higher Order Thinkin g	Projects / Mini Projects
Level 2 (L2) : Understanding							Level 5 (L5) : Evaluating							
Level 3 (L3) : Applying							Level 6 (L6) : Creating							
Mapping syllabus with Bloom’s Taxonomy LOT and HOT														
Unit No	Unit Name				L1	L2	L3	L4	L5	L6	LOT	HOT	Total	
Unit 1	FERROUS CAST ALLOYS				4	3	2	0	0	0	9	0	9	
Unit 2	NON-FERROUS CAST ALLOYS				2	5	2	0	0	0	9	0	9	
Unit 3	PHYSICAL METALLURGY OF WELDING				2	5	2	0	0	0	9	0	9	
Unit 4	WELDING OF ALLOY STEELS AND NON-FERROUS METALS				1	4	4	0	0	0	9	0	9	
Unit 5	DEFECTS, WELDABILITY AND STANDARDS				4	4	1	0	0	0	9	0	9	
Total					13	21	11	0	0	0	45	0	45	
Total Percentage					28.89	46.67	24.44	0	0	0	100	0	100	
CO PO Mapping														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1									1	2	1
CO2	1	1	1									1	2	1
CO3	1	1	1									1	2	1
CO4	1	1	1									1	2	1
CO5	1	1	1									1	2	1
Avg	1	1	1									1	2	1
Justification for CO-PO mapping														
CO1	PO1:Applying of engineering concept is more predominant, PO2: Applying the formulas and analyze the problems considered moderately. PO3 is related to Design Engineering Problems.													
CO2	PO1:Applying of engineering concept is more predominant, PO2: Applying the formulas and analyze the problems considered moderately. PO3 is related to Design Engineering Problems.													
CO3	PO1:Applying of engineering concept is more predominant, PO2: Applying the formulas and analyze the problems considered moderately. PO3 is related to Design Engineering Problems.													
CO4	PO1:Applying of engineering concept is more predominant, PO2: Applying the formulas and analyze the problems considered moderately. PO3 is related to Design Engineering Problems.													
CO5	PO1:Applying of engineering concept is more predominant, PO2: Applying the formulas and analyze the problems considered moderately. PO3 is related to Design Engineering Problems.													
3	High level				2		Moderate level			1		Low level		
Name & Sign of Faculty Incharge : Mr.Rajesh J														
Name & Sign of Subject Expert : Dr.Prasath.S														
Head of the Department : Dr.Shunmugasundaram														