

MOHAMMED SATHAK A J COLLEGE OF ENGINEERING

Siruseri IT park, OMR, Chennai - 603103

LESSON PLAN							
Department of Mechanical Engineering							
Name of the Subject	ENGINEERING MATERIALS AND METALLURGY		Name of the handling Faculty	RAJESH J			
Subject Code	ME3392		Year / Sem	II/III			
Acad Year	2022-2023		Batch	2021-2025			
Course Objective							
1. To learn the constructing the phase diagram and using of iron-iron carbide phase diagram for microstructure formation. 2. To learn selecting and applying various heat treatment processes and its microstructure formation. 3. To illustrate the different types of ferrous and non-ferrous alloys and their uses in engineering field. 4. To illustrate the different polymer, ceramics and composites and their uses in engineering field. 5. To learn the various testing procedures and failure mechanism in engineering field.							
Course Outcome							
CO1 Explain alloys and phase diagram, Iron-Iron carbon diagram and steel classification.							
CO2 Explain isothermal transformation, continuous cooling diagrams and different heat treatment processes.							
CO3 Clarify the effect of alloying elements on ferrous and non-ferrous metals.							
CO4 Summarize the properties and applications of non metallic materials.							
CO5 Explain the testing of mechanical properties.							
Lesson Plan							
Sl. No.	Topic(s)	T / R*	Periods Required	Mode of Teaching (BB / PPT / NPTEL / MOOC / etc)	Blooms Level (L1-L6)	CO	PO
		Book					
UNIT I - CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS							
1	Constitution of alloys	T1	1	BB	L1	CO1	PO1
2	Solid solutions, substitutional and interstitial	T1	2	BB	L2	CO1	PO1, PO2
3	Phase diagrams, Isomorphous, eutectic, eutectoid,	T1	2	BB	L2	CO1	PO1, PO2
4	Peritectic, and peritectoid reactions,	T1	1	BB	L2	CO1	PO1, PO2
5	Iron – carbon equilibrium diagram	T1	1	PPT	L3	CO1	PO1, PO2
6	Classification of steel and cast Iron microstructure	T1	1	BB	L2	CO1	PO1

7	Properties and application	T1	1	PPT	L1	CO1	PO1
Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any * Assignment given to the students							
UNIT II-HEAT TREATMENT							
8	Definition – Full annealing, stress relief, recrystallisation and spheroidising	T1	1	PPT	L1	CO2	PO1
9	Normalising, hardening and Tempering of steel	T1	1	PPT	L1	CO2	PO1
10	Isothermal transformation diagrams	T1	1	BB	L2	CO2	PO1, PO2
11	Cooling curves superimposed on I.T. diagram CCR	T1	1	PPT	L2	CO2	PO1, PO2
12	Hardenability, Jominy end quench test	T1	1	NPTEL	L3	CO2	PO1, PO2
13	Austempering, martempering	T1	1	BB	L3	CO2	PO1, PO2
14	Case hardening, carburizing, Nitriding	T1	1	PPT	L2	CO2	PO1
15	Cyaniding, carbonitriding, Flame and Induction hardening	T1	1	BB	L2	CO2	PO1
16	Vacuum and Plasma hardening.	T1	1	PPT	L3	CO2	PO1, PO2
Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any * Assignment given to the students							
UNIT III-FERROUS AND NON-FERROUS METALS							
17	Effect of alloying additions on steel α and β stabilisers	T2	1	BB	L2	CO3	PO1
18	Stainless and tool steels	T2	1	PPT	L1	CO3	PO1
19	HSLA, Maraging steels – Cast Iron	T2	1	BB	L2	CO3	PO1
20	Grey, white, malleable, spheroidal	T2	1	BB	L2	CO3	PO1
21	Alloy cast irons, Copper and copper alloys	T2	1	PPT	L2	CO3	PO1
22	Brass, Bronze and Cupronickel	T2	1	PPT	L1	CO3	PO1, PO2
23	Aluminium and Al-Cu	T2	1	PPT	L1	CO3	PO1, PO2
24	Precipitation strengthening treatment	T2	1	PPT	L3	CO3	PO1, PO2
25	Bearing alloys, Mg-alloys, Ni-based super alloys and Titanium alloys	T2	1	PPT	L2	CO3	PO1, PO2

Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any
*** Quiz given to the students**

UNIT IV-NON-METALLIC MATERIALS

26	Polymers – types of polymer commodity and engineering polymers	T1	1	BB/PPT	L2	CO4	PO1
27	Properties and applications of various thermosetting and thermoplastic polymers	T1	1	BB/PPT	L1	CO4	PO1
28	Properties and applications of PP, PS, PVC	T1	1	PPT	L1	CO4	PO1
29	Properties and applications of PMMA, PET,PC, PA	T1	1	PPT	L1	CO4	PO1
30	Properties and applications of ABS, PI, PAI, PPO	T1	1	PPT	L1	CO4	PO1
31	Properties and applications of PSS, PEEK, PTFE, Polymers	T1	1	PPT	L1	CO4	PO1
32	Urea and Phenol formaldehydes, Engineering Ceramics	T1	1	PPT	L2	CO4	PO1
33	Properties and applications of Al ₂ O ₃ , SiC, Si ₃ N ₄ , PSZ and SIALON	T1	1	PPT	L2	CO4	PO1
34	Composite, Matrix and Reinforcement Materials, Applications of Composites, Nano composites	T1	1	BB/PPT	L3	CO4	PO1, PO2

Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any
*** Assignment given to the students**

UNIT V-MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS

35	Mechanisms of plastic deformation	T1	1	PPT	L2	C05	PO1
36	Mechanism of slip and twinning	T1	1	PPT	L2	C05	PO1
37	Types of fracture	T1	1	PPT	L2	C05	PO1
38	Testing of materials under tension	T1	1	BB/PPT	L3	C05	PO1, PO2
39	Compression and shear loads	T1	1	BB/PPT	L3	C05	PO1, PO2
40	Hardness tests (Brinell, Vickers and Rockwell)	T1	2	BB/PPT	L3	C05	PO1, PO2
41	Impact test Izod and charpy	T1	1	BB/PPT	L3	C05	PO1, PO2
42	Fatigue and creep failure mechanisms	T1	1	PPT	L3	C05	PO1, PO2

Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any * MCQ given to the students										
Content Beyond the Syllabus Planned										
1	Advanced materials and characterization, Powder metallurgy									
Text Books										
1	Kenneth G.Budinski and Michael K. Budinski, “Engineering Materials”, Prentice Hall of India Private Limited, 9th edition ,2018.									
2	Sydney H.Avner, “Introduction to Physical Metallurgy”, McGraw Hill Book Company, 1994									
Reference Books										
1	A. Alavudeen, N. Venkateshwaran, and J. T.WinowlinJappes, A Textbook of Engineering Materials and Metallurgy, Laxmi Publications, 2006.									
2	Amandeep Singh Wadhwa, andHarvinder Singh Dhaliwal, A Textbook of Engineering Material and Metallurgy, University Sciences Press, 2008.									
3	G.S. Upadhyay and Anish Upadhyay, “Materials Science and Engineering”, Viva Books Pvt.Ltd, New Delhi, 2020.									
4	Raghavan.V, “Materials Science and Engineering”, Prentice Hall of India Pvt.Ltd. 6th edition, 2019.									
5	Williams D Callister, “Material Science and Engineering” Wiley India Pvt Ltd, 2nd edition Re print 2019.									
Website / URL References										
1	https://nptel.ac.in/courses/113/106/113106032									
Blooms Level										
Level 1 (L1) : Remembering		Lower Order Thinking	Fixed Hour Exams	Level 4 (L4) : Analysing					Higher Order Thinking	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	CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS	1	5	1	0	0	0	7	0	7
Unit 2	HEAT TREATMENT	2	4	3	0	0	0	9	0	9
Unit 3	FERROUS AND NON-FERROUS METALS	2	6	1	0	0	0	9	0	9
Unit 4	NON-METALLIC MATERIALS	5	3	1	0	0	0	9	0	9
Unit 5	MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS	0	3	5	0	0	0	8	0	8
Total		10	21	11	0	0	0	42	0	42
Total Percentage		23.81	50	26.19048	0	0	0	100	0	100

CO PO Mapping														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	3	1	3	2								2	2	1
CO2	3	1	3	1		2		1				2	2	1
CO3	3	1	3									2	2	1
CO4	3	1	3				2					2	2	1
CO5	3	1	3	2	2							2	2	1
Avg	3	1	3									2	2	1
Justification for CO-PO mapping														
CO1	Strongly mapped with PO1: Basic and fundamental engineering knowledge is required for understanding the subject, Moderately mapped with PO2: identification of phase changes of different materials is done													
CO2	Moderately mapped with PO1: Basic and fundamental engineering knowledge is required for understanding the subject, Strongly mapped with PO2: identification of phase changes of different materials is done													
CO3	Strongly mapped with PO1: Basic and fundamental engineering knowledge is required for understanding the subject, Moderately mapped with PO2: identification of phase changes of different materials is done													
CO4	Strongly mapped with PO1: Basic and fundamental engineering knowledge is required for understanding the subject, Low level mapped with PO2: identification of phase changes of different materials is done													
CO5	Strongly mapped with PO1: Basic and fundamental engineering knowledge is required for understanding the subject, Moderately mapped with PO2: identification of phase changes of different materials is done													
3		High level			2		Moderate level			1		Low level		
Name & Sign of Faculty Incharge : RAJESH J														
Name & Sign of Subject Expert :														
Head of the Department :														