



LESSON PLAN

Course Code	Course Title	Semester	Branches	Contact Periods /Week	Academic Year	Date of commencement of Semester
23ME3T03	Material Science and Metallurgy	III	Mechanical Engineering	5	2025-26	14-07-2025

COURSE OUTCOMES

CO1	Describe the different metals crystal structure and phase diagram. [K2]
CO2.	Illustrate various types of ferrous metals, their properties and applications. [K3]
CO3.	Explicate various types of nonferrous metals, their properties and applications. [K2]
CO4.	Summarize the different heat treatment processes. [K2]
CO5.	Demonstrate the metal powders producing Methods, Manufacturing and Applications. [K2]
CO6.	Infer the concepts of ceramics, composite materials and nano materials. [K2]

UNIT	Outcomes / Bloom's Level	Topics No.	Topics/Activity	Text Book / Reference	Contact Hour	Delivery Method
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STRUCTURE OF METALS AND CONSTITUTION OF ALLOYS

I	CO1. Describe the different metals crystal structure and phase diagram. [K2]	1.1	Introduction about Material Science	T1, T2, R1	1	Chalk & Talk, PPT, Active learning
		1.2	Crystallization of metals	T1, T2, R2	1	
		1.3	Crystal structure	T1, T2, R1	1	
		1.4	Grain boundaries & its effect	T1, T2, R3	1	
		1.5	Imperfections and its types	T1, T2, R1	1	
		1.6	Slip and Twinning	T2, T1, R1	1	
		1.7	Necessity of alloying & Types of solid solutions	T1, T2, R2	1	
		1.8	Hume Rothery's rules & Intermediate alloy phases	T1, T2, R2	1	
		1.9	Experimental methods of construction of equilibrium diagrams	T1, T2, R4	1	
		1.10	Isomorphous alloy systems	T2, T1, R1	1	
		1.11	Equilibrium cooling & heating of alloys	T1, T2, R2	1	
		1.12	Transformations in the solid state – allotropy, eutectoid, peritectoid reactions	T1, T2, R2	1	
			1.13	Study of binary phase diagrams such as Cu-Ni and Fe-Fe ₃ C	T1, T2, R2	
TOTAL					13	



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FERROUS METALS AND ALLOYS					
II	CO2. Illustrate various types of ferrous metals, their properties and applications. [K3]	2.1	Structure and properties of White cast iron and Malleable cast iron	T1, T2, R2	1
		2.2	Grey cast iron and Spheroidal graphite cast iron Structure and properties	T2, T1, R1	1
		2.3	Classification of steels	T1, T2, R2	1
		2.4	Structure and properties of plain carbon steels & low alloy steels	T1, T2, R1	1
		2.5	Structure and properties of Hadfield manganese steels	T1, T2, R1	1
		2.6	Structure and properties of tool and die steels	T1, T2, R1	1
		NON-FERROUS METALS AND ALLOYS			
		2.7	Structure and properties of Copper and Aluminium its alloys	T1, T2, R2	1
		2.8	Structure and properties of Titanium and its alloys	T1, T2, R2	1
		2.9	Magnesium and Super alloys Structure and properties	T1, T2, R2	1
CBS			Advanced Heat Treatment Techniques for Optimizing the Microstructure of Gray Cast Iron	Internet	1
TOTAL					10
HEAT TREATMENT OF STEELS					
III	CO4. Summarize the different heat treatment processes. [K2]	3.1	Effect of alloying elements on Fe-Fe ₃ C system	T1, T2, R2	1
		3.2	Heat Treatment and Annealing Process Types	T1, T2, R2	1
		3.3	Normalizing and Hardening Process	T2, R1, R2	1
		3.4	Tempering and Hardenability Process	T1, T2, R1	1
		3.5	TTT & CCT diagrams		1
		3.6	Surface Hardening and its Methods	T1, T2, R3	1
		3.7	Age hardening treatment	T1, T2, R1	1
		3.8	Cryogenic treatment of alloys	T1, T2, R3	1

Chalk & Talk, PPT, Videos

Chalk & Talk, PPT, Videos



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CBS			Cryogenic liquids	Internet	1	Videos
TOTAL					9	
POWDER METALLURGY						
IV	CO5. Demonstrate the metal powders producing Methods, Manufacturing and Applications. [K2]	4.1	Basic powder metallurgy processes	T1, T2, R2	1	Chalk & Talk, PPT, Videos, PBL
		4.2	Methods of producing metal powders	T2, T1, R1	1	
		4.3	Atomization and Chemical Reduction methods	T1, T2, R3	1	
		4.4	Electrolytic Deposition and Milling methods	T1, T2, R2	1	
		4.5	Granulation Process	T1, T2, R1	1	
		4.6	Compacting and Sintering methods	T1, T2, R2	1	
		4.7	Powder Metallurgy Secondary operations	T12, T1,R1	1	
		4.8	Applications of powder metallurgical products	T1, T2, R1	1	
CBS			Metal Powder for Additive Manufacturing	T1, T2, R3	1	PPT, Videos
TOTAL					9	
CERAMIC AND ADVANCED MATERIALS						
V	CO6. Infer the concepts of ceramics, composite materials and nano materials. [K2]	5.1	Ceramics and its types- glasses, cermets & abrasive materials	T2, T1, R2	1	Chalk & Talk, PPT Videos
		5.2	Composites and its types	T1, T2, R2	1	
		5.3	Composite manufacturing methods	T1, T2, R1	1	
		5.4	Particle and fiber reinforced composites	T2, T1, R2	1	
		5.5	Polymer Matrix Composite and Metal Matrix Composite	T1, T2, R4	1	
		5.6	Ceramics Matrix Composite and Carbon – Carbon Composite	T2, T1, R2	1	
		5.7	Introduction to Nano materials	T1, T2, R1	1	
		5.8	Smart materials.	T2, T1, R3	1	
TOTAL					8	
CUMULATIVE PROPOSED PERIODS					49	

**DEPARTMENT OF MECHANICAL ENGINEERING****Text Books:**

S.No.	AUTHORS, BOOK TITLE, EDITION, PUBLISHER, YEAR OF PUBLICATION
T1	V. Rahghavan , Materials Science and Engineering: A First Course, 6 th Edition, PHI Publications, 2015
T2	Sidney H.Avener, Introduction to Physical Metallurgy, 2 nd Edition, Tata McGraw Hill Edition. 2011

Reference Books:

S.No.	AUTHORS, BOOK TITLE, EDITION, PUBLISHER, YEAR OF PUBLICATION
R1	V.D. Kodgire, S. V. Kodgire, Material science and metallurgy, 43 rd Edition, Everest Publishing House, 2018
R2	R. Balasubramaniam, Callister's, Material Science and Engineering, 2 nd Edition , Wiley, 2014
R3	O. P. Khanna , Material Science & Metallurgy, 2 nd Edition , Dhanpatrai publications, 2014
R4	R. K. Rajput, Engineering materials and metallurgy, Revised edition, S.Chand & company, 2012

	Name	Signature with Date
i.	Faculty	Dr. R Sanjeev Kumar [Signature] 9/7/25
ii.	Course Coordinator	Dr. R Sanjeev Kumar [Signature]
iii.	Module Coordinator	Dr. D Bhanu Prakash D. Bhanu Prakash
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Principal