



**LESSON PLAN**

Course Code	Course Title	Semester	Branches	Contact Periods /Week	Academic Year	Date of commencement of Semester
20ME3T02	Material Science and Metallurgy	III	Mechanical Engineering	5	2024-25	30-07-2024
<b>COURSE OUTCOMES</b>						
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
<b>STRUCTURE OF METALS AND CONSTITUTION OF ALLOYS</b>						
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, 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 and heating of alloys	T1, T2, R2	1	
		1.12	Transformations in the solid state – allotropy, eutectoid, peritectoid reactions		1	
		1.13	Study of binary phase diagrams such as Cu-Ni and Fe-Fe <sub>3</sub> C		1	



					<b>TOTAL</b>	<b>13</b>
II	CO2. Illustrate various types of ferrous metals, their properties and applications. [K3]	<b>FERROUS METALS AND ALLOYS</b>				Chalk & Talk, PPT, Videos
		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	
		<b>NON-FERROUS METALS AND ALLOYS</b>				
		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		Tungsten carbides	Internet	1		
<b>TOTAL</b>					<b>10</b>	
<b>HEAT TREATMENT OF STEELS</b>						
III	CO3.Explicate various types of nonferrous metals, their properties and applications. [K2]  CO4. Summarize the different heat treatment processes.[K2]	3.1	Effect of alloying elements on Fe-Fe <sub>3</sub> C system	T1, T2, R2	1	Chalk & Talk, PPT, Videos
		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	
CBS		Cryogenic liquides	Internet	1	Videos	
<b>TOTAL</b>					<b>9</b>	



<b>POWDER METALLURGY</b>						
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			Magnesium Metal Powder	T1, T2, R3	1	PPT, Videos
<b>TOTAL</b>					<b>9</b>	
<b>CERAMIC AND ADVANCED MATERIALS</b>						
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	
<b>TOTAL</b>					<b>8</b>	
<b>CUMULATIVE PROPOSED PERIODS</b>					<b>49</b>	
<b>Text Books:</b>						
<b>S.No.</b>	<b>AUTHORS, BOOK TITLE, EDITION, PUBLISHER, YEAR OF PUBLICATION</b>					
T1	V. Rahghavan , Materials Science and Engineering: A First Course, 6 <sup>th</sup> Edition, PHI Publications, 2015					



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**DEPARTMENT OF MECHANICAL ENGINEERING**

T2	Sidney H.Avener, Introduction to Physical Metallurgy, 2 <sup>nd</sup> Edition, Tata McGraw Hill Edition, 2011
<b>Reference Books:</b>	
<b>S.No.</b>	<b>AUTHORS, BOOK TITLE, EDITION, PUBLISHER, YEAR OF PUBLICATION</b>
R1	V.D. Kodgire, S. V. Kodgire, Material science and metallurgy, 42 <sup>th</sup> Edition, Everest Publishing House, 2018
R2	R. Balasubramaniam, Callister's, Material Science and Engineering, 2 <sup>nd</sup> Edition, Wiley, 2014
R3	O. P. Khanna, Material Science & Metallurgy, 2 <sup>nd</sup> 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
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