

LESSON PLAN

Discipline: Metallurgical Engineering	Semester: 5th Semester	Name of the Teaching Faculty: Ms. Sitanjali Khuntia
Subject: Heat Treatment Sub code: (Th-2)	No of days /week class allotted:03	Semester from Date: 01/07/2026 to 05/11/2026 No of weeks: 20

COURSE OUT COMES:

CO1. Know the Principles of Heat Treatment

CO2. Explore Various Heat Treatment Processes

CO3. Familiarize students with different heat treatment techniques such as annealing, normalizing, hardening, tempering, and surface hardening.

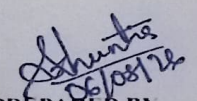
CO4. Analyse the Influence of Heat Treatment on Material Properties

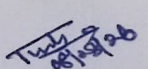
CO5. Study how heat treatment affects mechanical properties like hardness, toughness, strength, and wear resistance in ferrous and non-ferrous alloys.

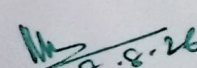
CO6. Develop Practical Skills for Industrial Applications.

Month	week	No of periods available	Class day	Theory topics	CO
July	1 st	3P	01-07-2026	Definition, Objectives, and Industrial Applications of Heat Treatment	CO1
			02-07-2026	Phase Diagrams with Emphasis on the Iron-Carbon System	CO1
			03-07-2026	Critical Temperatures (A1, A3, Acm) and Their Metallurgical Significance	CO1
	2 nd	3P	08-07-2026	Solid state phase transformation	CO1
			09-07-2026	Phase Transformations: Diffusion, introduction to diffusion, Fick's law	CO1
			10-07-2026	Introduction to diffusion, Fick's law of diffusion: 1st law	CO1
	3 rd	2P	15-07-2026	Fick's second law	CO1
			17-07-2026	Explaining the mechanism of formation of austenite	CO1
			22-07-2026	Mechanism of formation of austenite, austenitic grain size	CO1
	4 th	3P	23-07-2026	Discuss austenite grain size, importance of austenite grain size	CO4
			24-07-2026	Explaining the methods of determination of austenitic grain size: ASTM methods	CO6
			29-07-2026	Explaining the methods of determination of austenitic grain size: Heyn's intercept method	CO6
	5 th	3P	30-07-2026	CLASS TEST	CO4
			31-07-2026	Discuss the methods of control austenite grain size	CO2
Aug	2 nd	3P	06-08-2026	Discussion decomposition of austenite and pearlite transformation	CO2
			07-08-2026	Introduction of TTT diagram, study of isothermal transformation	CO2
	3 rd	2P	13-08-2026	Study of isothermal transformation, Construction of TTT curve	CO2
			14-08-2026	Explanation of TTT curve, Applications of TTT diagram	CO2
	4 th	2P	20-08-2026	limitations of TTT curve Critical cooling rate, Different TTT diagram for hypo- eutectoid, eutectoid and hyper-eutectoid steel, factors affecting TTT-curve Introduction of CCT curve, construction of CCT diagram	CO2
			21-08-2026	factors affecting TTT-curve Introduction of CCT curve, construction of CCT diagram, construction of CCT diagram	CO2
			28-08-2026	construction of CCT diagram	CO2
	5 th	3P	29-08-2026	Different cooling rate for eutectoid steel in CCT curve Explaining pearlitic, bainitic transformation	CO2

Sep	1 st	3P	03-09-2026	1 st Internal Assessment	
			05-09-2026	Explaining martensitic transformation Different heat treatment processes in steels: Annealing	CO3
	2 nd	2P	10-09-2026	Different types of annealing: full annealing	CO3
				Explaining homogenizing annealing, recrystallisation annealing, isothermal annealing, process annealing, Explaining spheroidization annealing, stress relieving annealing	CO3
			11-09-2026		
	3 rd	4P	17-09-2026	Explaining spheroidization annealing, stress relieving annealing	CO3
			18-09-2026	Explaining the process of normalization, comparison between annealing and normalization	CO3, CO4
			19-09-2026	Discuss the process of hardening, Describe the factors affecting hardening	CO3, CO4
			24-09-2026	Different methods of hardening: Process of quenching	CO3
	4 th	2P	25-09-2026	Tempering: Purpose, Mechanisms, and Effects of Tempering Temperature	CO3, CO4
Oct	1 st	3P	01-10-2026	Thermomechanical Processing (TMP): Principles and Applications, Special Processes: Austempering,	CO3
			03-10-2026	Martempering, Cryogenic Treatment	
	2 nd	2P	08-10-2026	Heat Treatment of Non-Ferrous Alloys (Aluminum, Copper, Titanium Alloys)	CO3, CO5
			09-10-2026	Age Hardening of aluminum alloy, Importance of hardness & hardenability, the method of determination of hardenability	CO4
	3 rd	2P	15-10-2026	Gross Man's critical diameter method & Jominey end quench method	CO6
			16-10-2026	Surface Hardening Techniques: Objectives of surface hardening, the methods of case depth measurement of steel	CO3, CO6
			22-10-2026	Pack carburizing, liquid carburizing, gas carburizing, Nitriding, Cyaniding, Carbonitriding	CO3
	4 th	2P	23-10-2026	Post carburizing heat treatment., Advanced Techniques: Induction Hardening, Flame Hardening, Laser Hardening	CO3, CO4
			29-10-2026	2 nd Internal Assessment	
	5 th	4P	30-10-2026	Heat Treatment Furnaces: Box, Pit, Salt Bath, and Vacuum Furnaces, Heat Treatment Defects	CO6
				Special Steels: Tool Steels, Stainless Steels (Austenitic (304, 316), Ferritic (430), Martensitic (410, 420), Duplex (2205), High-Strength Low-Alloy (HSLA) Steels	CO5
			31-10-2026		
Nov	1 st	1P	05-11-2026	Creep- Resistant Steels (Heat-Resistant Steels), Duplex and Super Duplex Stainless Steels, Hadfield Manganese Steel (High-Mn Steel), TRIP and TWIP Steels	CO5


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