

# Lesson Plan

**Name of the faculty:** Sh. Mohit Kadyan, Lecturer in Mechanical Engg.

**Discipline:** Mechanical Engg.

**Semester:** 4<sup>th</sup> Mechanical (A & B)

**Subject:** Materials and Metallurgy

**Lesson Plan Duration:** 15 weeks

**Work Load (Lecture/ Practical) per week (in hours):** Lectures- 03, Practicals- 02

Week	Theory		Practical	
	Lecture day	Topic ( including assignment / test)	Practical Day	Topic
1 <sup>st</sup>	1 <sup>st</sup>	Material, Engineering materials. History of material origin, Scope of Material Science.	1 <sup>st</sup>	Classification of about 25 specimens of materials/ machine parts into i) Metals and non metals
	2 <sup>nd</sup>	Overview of different engineering materials and applications	2 <sup>nd</sup>	ii) Metals and alloys
	3 <sup>rd</sup>	Importance, Classification of materials, Difference b/w metals and non- metals.		
2 <sup>nd</sup>	1 <sup>st</sup>	Physical and mechanical properties of various materials.	1 <sup>st</sup>	iii) Ferrous and non ferrous metals
	2 <sup>nd</sup>	Present and future needs of materials.		
	3 <sup>rd</sup>	Various issues of Material Usage- Economical, Environment and Social. Overview of Biomaterials and Semiconducting materials.	2 <sup>nd</sup>	iv) Ferrous and non ferrous alloys.
3 <sup>rd</sup>	1 <sup>st</sup>	Fundamentals: Crystalline solid and amorphous solid.	1 <sup>st</sup>	Given a set of specimen of metals and alloys; identify and indicate the various properties possessed by them.
	2 <sup>nd</sup>	Unit cell, space lattice, Arrangement of atoms in simple cubic crystals, BCC, FCC and HCP Crystals.		
	3 <sup>rd</sup>	No. of atoms per unit cell, Atomic packing factor, coordination number.	2 <sup>nd</sup>	Given a set of specimen of metals and alloys; identify and indicate the various properties possessed by them.

4 <sup>th</sup>	1 <sup>st</sup>	Defects/ Imperfections, types and effects in solid materials. Deformation: overview of deformation behavior and its mechanisms.	1 <sup>st</sup>	a) Study of heat treatment furnace.
	2 <sup>nd</sup>	Elastic and plastic deformation Behaviour of material under load and stress- strain curve.		
	3 <sup>rd</sup>	Failure Mechanisms: overview of failure modes, fracture, fatigue and creep.		
5 <sup>th</sup>	1 <sup>st</sup>	Metallurgy: Introduction , cooling curves of pure metals, dendritic solidification of metals.	1 <sup>st</sup>	a) Study of a thermocouple/ pyrometer
	2 <sup>nd</sup>	Effect of grain size on mechanical properties. Binary alloys		
	3 <sup>rd</sup>	Thermal equilibrium diagrams. Lever rule	2 <sup>nd</sup>	b) Study of a thermocouple/ pyrometer
6 <sup>th</sup>	1 <sup>st</sup>	Solid solution alloys. Ferrous Metals: Different iron ores	1 <sup>st</sup>	Study of a metallurgical microscope and a specimen polishing machine.
	2 <sup>nd</sup>	flow diagram for production of iron and steel.		
	3 <sup>rd</sup>	Allotropic forms of iron- alpha, delta, gamma.	2 <sup>nd</sup>	Study of a metallurgical microscope and a specimen polishing machine.
7 <sup>th</sup>	1 <sup>st</sup>	Basic process of manufacturing of pig iron and steel- making.	1 <sup>st</sup>	To prepare specimens of following materials for microscopic examination and to Examine the microstructure of the specimens of following materials. i) Brass ii) copper iii) Cast Iron iv) Mild Steel v) HSS vi) Aluminum
	2 <sup>nd</sup>	Cast Iron: Properties, types of cast Iron and their use.		
	3 <sup>rd</sup>	Steels: Plain carbon steels and alloy steel. Classification of plain carbon steels,	2 <sup>nd</sup>	To prepare specimens of following materials for microscopic examination and to Examine the microstructure of the specimens of following

				materials. i) Brass ii) copper iii) Cast Iron iv) Mild Steel v)HSS vi) Aluminum
8 <sup>th</sup>	1 <sup>st</sup>	Properties of different types of plain carbon steels.	1 <sup>st</sup>	To anneal a given specimen and find out difference in hardness as a result of annealing.
	2 <sup>nd</sup>	Application of different types of plain carbon steels.		
	3 <sup>rd</sup>	Effect of various alloying elements on properties of steel. Uses of alloy steels.	2 <sup>nd</sup>	To anneal a given specimen and find out difference in hardness as a result of annealing.
9 <sup>th</sup>	1 <sup>st</sup>	Non ferrous Materials: Properties	1 <sup>st</sup>	To normalize a given specimen and to find out the difference in hardness as a result of normalizing.
	2 <sup>nd</sup>	Uses of copper. Aluminum and their alloys.		
	3 <sup>rd</sup>	Definition and objectives of heat treatment.	2 <sup>nd</sup>	To normalize a given specimen and to find out the difference in hardness as a result of normalizing.
10 <sup>th</sup>	1 <sup>st</sup>	Iron carbon equilibrium diagram	1 <sup>st</sup>	To harden and temper a specimen and to find out the difference in hardness due to tempering.
	2 <sup>nd</sup>	Different microstructures of iron and steel.		
	3 <sup>rd</sup>	Formation and decomposition of Austenite	2 <sup>nd</sup>	To harden and temper a specimen and to find out the difference in hardness due to tempering.
11 <sup>th</sup>	1 <sup>st</sup>	Martensitic Transformation.		
	2 <sup>nd</sup>	Various heat treatment processes- hardening.		
	3 <sup>rd</sup>	Tempering, Annealing, normalizing.		
12 <sup>th</sup>	1 <sup>st</sup>	Surface hardening, carburizing.		
	2 <sup>nd</sup>	Nitriding, Cyaniding.		
	3 <sup>rd</sup>	Hardenability of Steels.		
13 <sup>th</sup>	1 <sup>st</sup>	Types of heat treatment furnaces. Measurement of temperature of furnaces.		
	2 <sup>nd</sup>	Rubber classification- Natural and synthetic. Selection of rubber.		
	3 <sup>rd</sup>	Heat Insulating materials- Asbestos, glasswool, thermocole.		

14 <sup>th</sup>	1 <sup>st</sup>	Ceramics- Classification, Properties, applications.		
	2 <sup>nd</sup>	Refractory materials- Dolomite, porcelain. Glass- Soda lime, borosil.		
	3 <sup>rd</sup>	Joining materials/ Adhesives- Classification, Properties and applications.		
15 <sup>th</sup>	1 <sup>st</sup>	Abrasive materials. Composites- Classification, properties, applications.		
	2 <sup>nd</sup>	Materials for bearing metals. Materials for Nuclear Energy.		
	3 <sup>rd</sup>	Smart materials- properties and applications.		