

GOVT. POLYTECHNIC UMRI, KKR

LESSON PLAN

Name of Faculty	Dr. RASHMI ARYA
Discipline	Mechanical Engineering
Semester	4 th
Subject	Materials and Metallurgy

Lesson Plan Duration : 15 Weeks

Work Load (Lecture/ Practical) : 03 Lectures/Week, **Practicals:** 02 Hours/Turn/Week

	THEORY		PRACTICAL	
WEEK	LECTURE DAY	TOPIC	PRACTICAL DAY	TOPIC
1st	1st	UNIT-1.(1)Introduction:- Material: Engineering materials,	1st	Classification of about 25 specimens of materials/ machine parts (i) Metals and non metals (ii) Metals and alloys (iii) Ferrous and non ferrous metals (iv) Ferrous and non ferrous alloys
	2 nd	Overview of different engineering materials and applications,		
	3 rd	Importance, Classification of materials, Difference between metals and non-metals		
2 nd	4 th	Overview of Biomaterials and semi conducting materials.	2nd	Given a set of specimen of metals and alloys (copper, brass, aluminium, cast ironHSS, Gun metal); identify and indicate the various properties possessed by them
	5 th	UNIT-II. (2) Crystallography Fundamentals: Crystalline solid and amorphous solid,		
	6 th	Unit Cell, Space Lattice		
3 rd	7 th	Arrangement of atoms in Simple Cubic Crystals, BCC, FCC and HCP Crystals	3 rd	a) Study of heat treatment furnace.
	8 th	Number of atoms per unit Cell,		
	9 th	Atomic PackingFactor, coordination number (without derivation),		
4 th	10 th	Defects/ Imperfections, types and effects in Solid materials. Deformation: Overview of deformation behavior and its mechanisms,	4 TH	b) Study of a thermocouple/pyrometer.
	11 th	Elastic and Plastic deformation		
	12 th	Failure Mechanisms: Overview of failure modes, fracture, fatigue and creep		
5 th	13 th	SESSIONAL TEST		
6 th	14 th	UNIT-II. (3) <u>Metallurgy</u>: Introduction, Cooling curve of pure metals, Dendritic solidification of metals, effect of grain size on mechanical properties,	6 th	Study of a metallurgical microscope and aspecimen polishing machine
	15 th	Binary alloys, Thermal equilibrium diagrams,		
	16	Lever rule, Solid Solution alloys		
7 th	17 th	UNIT-III. (4) <u>Metals And Alloys: Ferrous Metals</u>: Different iron ores Flow diagram for production of iron and steel Allotropic forms of iron- Alpha, Delta, and Gamma.	7 th	To prepare specimens of following materials for microscopic examination andto Examine the microstructure of the specimens of following materials• (At least any two) i) Brass ii) Copper iii) Cast Iron, iv) Mild Steel v) HSS, vi) Aluminium vii) Stainless steel
	18 th	Basic process of manufacturing of pig iron, Basic process of steel-making, Cast Iron: Properties, types of Cast Iron, manufacture and their use.		
	19 th	Steels: Plain carbon Steels and alloy steel, Classification of plain carbon steels, Properties and application of different types of Plain Carbon Steels, Effect of various alloying elements on properties of steel, uses of alloy steel (high speed steel, silicon steel, spring steel),		
8 th	20 th	Stainless steel: Definition, importance and criticality (Life cycle cost, Corrosion impact; difference with Steel, Per Capita consumption; growth rate of SS vs other materials, World vs India).	8 th	Revision of previous practical

	21 th	Various grades of SS and their nomenclature, Effect of alloying elements, Unique characteristics of various grades of SS		
	22 th	Manufacturing of SS: Process flow, Raw materials for SS manufacturing functions of each processing unit, Downstream facilities, Various finishes of SS.		
9 th	23 th	Fabrication and testing of SS: Stud welding method, Weldability and effect of welding on various types of SS, Defects like Sensitization and microfissure, Relative observations and precautions while performing the processes: cutting , Buffing, Bending, Roll forming, Embossing, Polishing of Stainless steel.	9 th	To anneal a given specimen and find out difference in hardness as a result of annealing.
	24 th	Chemical treatment like pickling and passivation for SS, Applications of SS : Demand of SS in various segments,		
	25 th	Overview of SS applications in Automobile, railway, and transport. Architectural, building construction applications and Process Industries. Non Ferrous Materials : properties and Uses of Copper, Aluminum and their alloys		
10 th	26 th	SESSIONAL TEST		
11 th	27 st	UNIT-IV. <u>Heat Treatment:</u> Definition and objectives of heat treatment, Iron carbon equilibrium diagram different microstructures of iron and steel	11 th	To normalize a given specimen and to findout the difference in hardness as a result ofnormalizing
	28 th	Formation and decomposition of Austenite, Martensitic Transformation. Various heat treatment processes- hardening, tempering		
	29 th	Annealing, normalizing, Surface hardening ,carburizing, nitriding, cyaniding , hardenability of steels, Types of heat treatment Furnaces (only basic idea) Measurement of temperature of furnaces.		
12 th	30 th	UNIT-6. (5) <u>PLASTICS:</u> Importance of plastics, Classification Thermoplastic and thermoset, plastic and their uses, Various trade names of plastics, Plastic coatings	12 th	To harden and temper a specimen and to find out the difference in hardness due tot tempering.
	31 th	Food grade plastics. Applications of plastics in automobile and domestic use. Rubber classification–Natural and synthetic. Selection of rubber wool, thermocole.		
	32 th	Ceramics- Classification, properties, applications. Refractory materials–Dolomite, porcelain. Glass– Soda lime, borosil Abrasive materials,		
13 th	33 th	Joining materials / Adhesives–Classification, properties and applications	13 th	Demo of welding defects like sensitization and microfissure in stainless steel.
	34 th	Composites- Classification, properties, applications		
	35 th	Materials for bearing metals,Materials for Nuclear, Energy, Smart materials-properties and applications		
14 th	36	Revision	14 th	Revision
	37	Revision		
	38	Revision		
15 th		SESSIONAL TEST		

