Lesson Plan

Name of the Faculty : Sh. Munish Kumar Jain

Discipline : Mechanical Engineering

Semester : 4th

Subject : **MATERIALS AND METALLURGY**

Lesson Plan duration : 15 weeks (from 22nd March, 2021 to 2nd July, 2021)

Work load per week : Lecture – 04, Practical – 02

Week	Theory		Practical	
	Lecture Day	Topic (Including assessment/test)	Practical Day	Topic
1st	1st	**1. Introduction:** Material, Engineering materials,	1st	Classification of about 25 specimens of materials/machine parts into (i) Metals and non metals (ii) Metals and alloys
	2nd	History/Timeline of Material Origin, Scope of Material Science,		
	3rd	Overview of different engineering materials and applications, Importance,		
	4th	Classification of materials, Difference between metals and non-metals,		
2nd	5th	Physical properties of various materials,	2nd	Given a set of specimen of metals and alloys (copper, brass, aluminium, cast iron, HSS, Gun metal); identify and indicate the various properties possessed by them.
	6th	Mechanical properties of various materials, Present and future needs of materials,		
	7th	Various issues of Material Usage- Economical, Environment and Social,		
	8th	Overview of Biomaterials and semi-conducting materials		
3rd	9th	**2. Crystallography :** Fundamentals: Crystalline solid and amorphous solid,	3rd	a) Study of heat treatment furnace. b) Study of a thermocouple/pyrometer.
	10th	Unit Cell, Space Lattice, Arrangement of atoms in Simple Cubic Crystals, BCC,		
	11th	FCC and HCP Crystals,		

	12th	Number of atoms per unit Cell in BCC, FCC, HCP		
4th	13th	Atomic Packing Factor, coordination number (without derivation), Defects/Imperfections	4th	Study of a metallurgical microscope and a specimen polishing machine
	14th	Types and effects in Solid materials, Deformation: Overview of deformation behaviour and its mechanisms,		
	15th	Elastic and Plastic deformation		
	16th	Behaviour of material under load and stress-strain curve		
5th	17th	Failure Mechanisms: Overview of failure modes,	5th	To prepare specimens of following materials for microscopic examination and to 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
	18th	Fracture, fatigue and creep		
	19th	**3. Metallurgy :** Introduction, Cooling curves of pure metals,		
	20th	Dendritic solidification of metals, Effect of grain size on mechanical properties,		
6th	21st	Binary alloys, Thermal equilibrium diagrams,	6th	Checking of practical File
	22nd	Lever rule, Solid Solution alloys		
	23rd	**1st Sessional Test (Tentative)**		
	24th	**Assessment**		
7th	25th	**4. Metals And Alloys :** Ferrous Metals: Different iron ores, Flow diagram for production of iron and steel,	7th	To prepare specimens of following materials for microscopic examination and to 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
	26th	Allotropic forms of iron- Alpha, Delta, Gamma. Basic process of manufacturing of pig iron and steel-making.		
	27th	Cast Iron: Properties of cast iron, Types of Cast Iron,		
	28th	Cast Iron manufacture and their uses		

8th	29th	Steels : Plain carbon Steels and alloy steel, Classification of plain carbon steels	8th	To anneal a given specimen and find out difference in hardness as a result of annealing.
	30th	Properties and Application of different types of Plain Carbon Steels,		
	31st	Effect of various alloying elements on properties of steel, Uses of alloy steels (high speed steel, stainless steel, silicon steel, spring steel)		
	32nd	Non Ferrous Materials: Properties and uses of Copper, Properties and uses of Aluminium and their alloys		
9th	33rd	**5. Heat Treatment :** Definition and objectives of heat treatment, Iron carbon equilibrium diagram	9th	To anneal a given specimen and find out difference in hardness as a result of annealing.
	34th	Different microstructures of iron and steel. Formation and decomposition of Austenite, Martensitic Transformation		
	35th	Various heat treatment processes- hardening, tempering, ,		
	36th	annealing, normalizing,		
10th	37th	Various surface hardening processes carburizing, nitriding, cyaniding,	10th	Checking of practical File
	38th	Hardenability of Steels, Types of heat treatment furnaces (only basic idea), measurement of temperature of furnaces		
	39th	**2nd Sessional Test (Tentative)**		
	40th	**Assessment**		
11th	41st	**6. Plastics :** Importance of plastics, Classification-thermoplastic and thermoset plastic	11th	To normalize a given specimen and to find out the difference in hardness as a result of normalizing.
	42nd	Plastics and their uses,		
	43rd	Various trade names of plastics,		
	44th	Plastic coatings, food grade plastics.		

12th	45th	Applications of plastics in automobile and domestic use	12th	To normalize a given specimen and to find out the difference in hardness as a result of normalizing.
	46th	Rubber classification - Natural and synthetic. Selection of rubber		
	47th	**7. Advanced Materials :** Heat Insulating materials- Asbestos, glasswool, thermocole		
	48th	Ceramics-Classification, properties, applications		
13th	49th	Refractory materials –Dolomite, porcelain.	13th	To harden and temper a specimen and to find out the difference in hardness due to tempering.
	50th	Glass – Soda lime, borosil,		
	51st	Joining materials/Adhesives – Classification, properties and applications		
	52nd	Abrasive materials, Composites- Classification, properties, applications		
14th	53rd	Materials for bearing metals,	14th	To harden and temper a specimen and to find out the difference in hardness due to tempering.
	54th	Materials for Nuclear Energy		
	55th	Smart materials- properties and applications		
	56th	**3rd sessional test (Tentative)**		
15th	57th	**Assessment**	15th	Checking of Practical File & Evaluation
	58th	Revision		
	59th	Revision		
	60th	Revision		