

Lesson Plan for MATERIAL SCIENCE AND ENGINEERING(TH.3) , 3RD Semester,Mechanical Engg. (WINTER-2025)		
Discipline: Mechanical Engg	Semester: 3RD	Name of the Teaching Faculty: Sri B.K.Dash, Senior Lecturer,Mechanical
SUBJECT: MATERIAL SCIENCE AND ENGINEERING(TH.3)	No. of Days/ week class allotted=3	Semester Starts from 14.07.2025

WEEK	PERIOD	TOPICS TO BE COVERED
1	Unit-I:Crystal structures and Bonds	
	1	Unit cell and space lattice: Crystal system: The seven basic crystal systems
	2	Crystal structure for metallic elements: BCC, FCC and HCP
	3	Coordination number for Simple Cubic, BCC and FCC
2	4	Atomic radius: definition, atomic radius for Simple Cubic, BCC and FCC
	5	Atomic Packing Factor for Simple Cubic, BCC, FCC and HCP
	6	Simple problems on finding number of atoms for a unit cell.
3	7	Bonds in solids: Classification - primary or chemical bond, secondary or molecular bond
	8	Types of primary bonds: Ionic, Covalent and Metallic Bonds
	9	Types of secondary bonds: Dispersion bond, Dipole bond and Hydrogen bond
4	Unit-II: Phase diagrams, Ferrous metals and its Alloys	
	10	Isomorphs, eutectic and eutectoid systems
	11	Iron-Carbon binary diagram; Iron and Carbon Steels;
	12	flow sheet for production of iron and steel
5	13	Iron ores – Pig iron: classification, composition and effects of impurities on iron
	14	Cast Iron: classification, composition, properties and uses
	15	Wrought Iron: properties, uses/applications of wrought Iron; comparison of cast iron, wrought iron and mild steel and high carbon steel
6	16	standard commercial grades of steel as per BIS and AISI
	17	Alloy Steels – purpose of alloying; effects of alloying elements – Important alloy steels
	18	Silicon steel, High Speed Steel (HSS), heat resisting
7	19	steel, spring steel,Stainless Steel (SS): types of SS
	20	applications of SS – magnet steel – composition, properties and uses
	Unit-III:Non-ferrous metals and its Alloys	
	21	Properties and uses of aluminum, copper
8	22	Properties and uses tin, lead, zinc
	23	Properties and uses magnesium and nickel
	24	Copper alloys: Brasses, bronzes – composition, properties and uses
	25	Aluminum alloys: Duralumin, hinalium, magnelium – composition, properties and uses
9	26	Nickel alloys: Inconel, monel, nicPerome –composition, properties and uses.
	27	Anti-friction/Bearing alloys: Various types of bearing bronzes
	28	Standard commercial grades as per BIS/ASME.
10	Unit-IV:Failure analysis & Testing of Materials	
	29	Introduction to failure analysis
	30	Fracture: ductile fracture, brittle fracture
11	31	cleavage; notch sensitivity
	32	fatigue; endurance limit; characteristics of fatigue fracture
	33	variables affecting fatigue life

12	34	creep; creep curve; creep fracture
	35	Destructive testing: Tensile testing
	36	compression testing; Hardness testing: Brinell, Rockwell
13	37	bend test; torsion test, fatigue test; creep test
	38	Non-destructive testing: Visual Inspection; magnetic particle inspection; liquid penetrant test; ultrasonic inspection; radiography
	Unit-V: Corrosion & Surface Engineering	
	39	Nature of corrosion and its causes; Electro chemical re-actions
14	40	Electrolytes; Factors affecting corrosion: Environment, Material properties and physical conditions
	41	Types of corrosion; Corrosion control: Material selection, environment control and design
	42	Surface engineering processes: Coatings and surface treatments; Cleaning and mechanical finishing of surfaces;
15	43	Organic coatings; Electroplating and Special metallic plating; Electro polishing and photo-etching
	44	Conversion coatings: Oxide, phosphate and chromate coatings; Thin film coatings: PVD and CVD; Surface analysis
	45	Hard-facing, thermal spraying and high-energy processes; Process/material selection. Pollution norms for treating effluents as per standards.

P. P. S.

Concerned faculty

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HOD 11/07/2025

Govt. Polytechnic Kandhamal