

SYNERGY SCHOOL OF ENGINEERING, DHENKANAL

Academic Lesson Plan for Material Science & Engg (Winter-2025)		
Discipline: Mechanical Engineering	Semester: 3rd	Name of Faculty: SOMANATH SETHY
Subject: Material Science & Engg.	No. of days/per week Class Allotted: 3	Semester from: 14/7/25 - End Date: 15/11/25
		No. of weeks: 15
Week	Class Day	Theory Topics
1st	1st	Crystal structures and Bonds: Unit cell and space lattice: Crystal system: The seven basic crystal systems
	2nd	Crystal structure for metallic elements: BCC, FCC and HCP; Coordination number for Simple Cubic, BCC and FCC
	3rd	Atomic radius: definition
2nd	1st	atomic radius for Simple Cubic
	2nd	BCC and FCC
	3rd	Atomic Packing Factor for Simple Cubic, BCC, FCC and HCP
3rd	1st	Simple problems on finding number of atoms for a unit cell.
	2nd	Bonds in solids: Classification - primary or chemical bond, secondary or molecular bond; Types of primary bonds: Ionic, Covalent and Metallic Bonds
	3rd	Types of secondary bonds: Dispersion bond, Dipole bond and Hydrogen bond
4th	1st	Phase diagrams, Ferrous metals and its Alloys: Isomorphs, eutectic and eutectoid systems; Iron- Carbon binary diagram; Iron and Carbon Steels; flow sheet for production of iron and steel
	2nd	Iron ores – Pig iron: classification
	3rd	composition and effects of impurities on iron

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5th	1st	Cast Iron: classification
	2nd	composition, properties and uses
	3rd	Wrought Iron: properties, uses
6th	1st	applications of wrought Iron; comparison of cast iron, wrought iron and mild steel and high carbon steel
	2nd	standard commercial grades of steel as per BIS and AISI; Alloy Steels
	3rd	purpose of alloying; effects of alloying elements – Important alloy steels: Silicon steel, High Speed Steel (HSS), heat resisting steel, spring steel, Stainless Steel (SS): types of SS, applications of SS – magnet steel – composition, properties and uses
7th	1st	Non-ferrous metals and its Alloys: Properties and uses of aluminum
	2nd	Properties and uses copper, tin, lead, zinc
	3rd	Properties and uses magnesium and nickel; Copper alloys: Brasses, bronzes
8th	1st	composition, properties and uses; Aluminium alloys: Duralumin, hinalium, magnelium
	2nd	composition, properties and uses; Nickel alloys: Inconel
	3rd	composition, properties and uses monellin Perone
9th	1st	composition, properties and uses. Anti-friction/Bearing alloys
	2nd	Various types of bearing bronzes
	3rd	Standard commercial grades as per BIS/ASME
	1st	Failure analysis & Testing of Materials: Introduction to failure analysis; Fracture: ductile fracture

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10th	2nd	Failure analysis & Testing of Materials: Introduction to brittle fracture
	3rd	Failure analysis & Testing of notch sensitivity; fatigue; endurance limit
11th	1st	characteristics of fatigue fracture; variables affecting fatigue life; creep; creep curve
	2nd	creep fracture; Destructive testing: Tensile testing;
	3rd	compression testing; Hardness testing: Brinell, Rockwell
12th	1st	bend test; torsion test; fatigue test; creep test
	2nd	Nondestructive testing
	3rd	Visual Inspection; magnetic particle inspection; liquid penetrant test; ultrasonic inspection; radiography.
13th	1st	Corrosion & Surface Engineering: Nature of corrosion and its causes
	2nd	Electro chemical re-actions
	3rd	Electrolytes; Factors affecting corrosion
14th	1st	Environment, Material properties and physical conditions
	2nd	Types of corrosion; Corrosion control: Material selection, environment control and design
	3rd	. Surface engineering processes: Coatings and surface treatments; Cleaning and mechanical finishing of surfaces; Organic coatings; Electroplating and Special metallic plating
15th	1st	Electro polishing and photoetching; – Conversion coatings: Oxide, phosphate and chromate coating
	2nd	Thin film coatings: PVD and CVD; Surface analysis; Hard-facing, thermal spraying and high energy processes; Process/material selection

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	3rd	Pollution norms for treating effluents as per standards.
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SOMANATH SETHY

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