GANAPATI INSTITUTE OF ENGINERING & TECHNOLOGY(Polytechnic),JAGATPUR,CUTTACK

DEPARTMENT OF MECHANICAL ENGINEERING.

LESSON PLAN-2025 WINTER

Discipline : Mechanical Engineering	**Semester:3rd**	**Name of the Teaching Faculty:- ANANDITA NANDA**
Subject: Material Science & Engineering [MEPC-205 TH:3]	**No. of Days/per week class allotted:03**	**Semester From Date : 14.07.2025 To Dates: 15.11.2025** **No. of Weeks:15**
Week	**Class Day**	**Theory Topics**
1ST	1st	**Unit-1: 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;
	3rd	Coordination number for Simple Cubic, BCC and FCC;
2ND	1st	Atomic radius: definition, atomic radius for Simple Cubic, BCC and FCC;
	2nd	Atomic Packing Factor for Simple Cubic, BCC, FCC and HCP;
	3rd	Simple problems on finding number of atoms for a unit cell.
3RD	1st	Bonds in solids: Classification - primary or chemical bond,
	2nd	Bonds in solids: Classification - secondary or molecular bond;
	3rd	Types of primary bonds: Ionic, Covalent and Metallic Bonds;
4TH	1st	Types of secondary bonds Dispersion bond, Dipole bond and Hydrogen bond
	2nd	**Unit-2: Phase diagrams, Ferrous metals and its Alloys:** Isomorphs, eutectic and eutectoid systems
	3rd	Iron-Carbon binary diagram; Iron and Carbon Steels; flow sheet for production of iron and steel
5TH	1st	Iron ores – Pig iron: classification, composition and effects of impurities on iron;
	2nd	Cast Iron: classification, composition, properties and uses;
	3rd	comparison of cast iron, wrought iron and mild steel and high carbon steel; standard commercial grades of steel as per BIS and AISI

6TH	1st	Wrought Iron: properties, uses/applications of wrought Iron;
	2nd	Alloy Steels – purpose of alloying; effects of alloying elements – Important alloy steels:
	3rd	Silicon steel, High Speed Steel (HSS), heat resisting steel, spring steel, Stainless Steel (SS)
7TH	1st	types of SS, applications of SS – magnet steel – composition, properties and uses
	2nd	**Unit-3:Non-ferrous metals and its Alloys:** Properties and uses of aluminium , copper, tin
	3rd	Aluminum alloys: Duralumin, hindalium, magnelium – composition, properties and uses;
8TH	1st	Properties and uses of lead, zinc, magnesium and nickel;
	2nd	Copper alloys: Brasses, composition, properties and uses;
	3rd	Bronzes – composition, properties and uses;
9TH	1st	Aluminum alloys: Duralumin, hindalium, magnelium – composition, properties and uses;
	2nd	Nickel alloys: Inconel, monel – composition, properties and uses.
	3rd	Nickel alloys: nicPerome – composition, properties and uses.
10TH	1st	Anti-friction/Bearing alloys: Various types of bearing bronzes - Standard commercial grades as per BIS/ASME
	2nd	**Unit-4: Failure analysis & Testing of Materials:** Introduction to failure analysis;
	3rd	Fracture: ductile fracture, brittle fracture; cleavage; notch sensitivity; fatigue; endurance limit;
11TH	1st	Characteristics of fatigue fracture;
	2nd	variables affecting fatigue life; creep; creep curve; creep fracture;
	3rd	Destructive testing: Tensile testing; compression testing;
12TH	1st	Hardness testing: Brinell , Rockwell; bend test;
	2nd	Torsion test; fatigue test; creep test.
	3rd	Non- destructive testing: Visual Inspection; magnetic particle inspection; liquid penetrant test;

13TH	1st	Ultrasonic inspection; radiography.
	2nd	**Unit-5:Corrosion & Surface Engineering:** Nature of corrosion and its causes;
	3rd	Electro chemical re-actions; Electrolytes;
14TH	1st	Factors affecting corrosion: 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;
15TH	1st	Cleaning and mechanical finishing of surfaces; Organic coatings; Electroplating and Special metallic plating;
	2nd	Electro polishing and photo-etching ;– Conversion coatings: Oxide, phosphate and chromate coatings;
	3rd	PVD and CVD; Surface analysis; Hard-facing, thermal spraying and high-energy processes; Process/material selection. Pollution norms for treating effluents as per standards

Learning Resources:

1. Material Science – GBS Narang –Khanna Publishers, New Delhi
2. Material Science – R.K.Rajput – Lakshmi Publication ,New Delhi
3. Material Science – R.S.Khurmi ,R.S.Sedha – S.Chand, Publication

Nanda 11.7.2025

Prepared By

12/07/25

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