

**GOVERNMENT POLYTECHNIC BALASORE**  
**LESSIONPLAN–MATERIAL SCIENCE & ENGINEERING**

Discipline: <b>MECHANICAL ENGG.</b>	Semester: <b>3<sup>RD</sup></b>	Name of the Teaching Faculty : <b>SRI MIHIRA KUMAR SOREN</b>
Subject: <b>MS&amp;M (MEPC205)</b>	No. of Days/perweek classallotted:3 P/W	SemesterFromdate: <b>14.07.2025</b> ToDate: <b>15.11.2025</b>  No.ofWeeks:15Week
<b>Week</b>	<b>ClassDay</b>	<b>TheoryTopics</b>
1 <sup>ST</sup>	1 <sup>st</sup>	<b>Crystal structures and Bonds</b> Unit cell and space lattice: Crystal system.
	2 <sup>nd</sup>	The seven basic crystal systems; Crystal structure for metallic elements.
	3 <sup>rd</sup>	BCC, FCC and HCP; Coordination number for Simple Cubic, BCC and FCC.
2 <sup>ND</sup>	1 <sup>st</sup>	Atomic radius: definition, atomic radius for Simple Cubic, BCC and FCC.
	2 <sup>nd</sup>	Atomic Packing Factor for Simple Cubic.
	3 <sup>rd</sup>	BCC, FCC and HCP; Simple problems on finding number of atoms for a unit cell.
3 <sup>RD</sup>	1 <sup>st</sup>	Bonds in solids: Classification - primary or chemical bond.
	2 <sup>nd</sup>	Secondary or molecular bond.
	3 <sup>rd</sup>	Types of primary bonds: Ionic, Covalent and Metallic Bonds.
4 <sup>TH</sup>	1 <sup>st</sup>	Types of secondary bonds: Dispersion bond, Dipole bond and Hydrogen bond.
	2 <sup>nd</sup>	<b>Phase diagrams, Ferrous metals and its Alloys</b> Isomorphs, eutectic and eutectoid systems; Iron-Carbon binary diagram.
	3 <sup>rd</sup>	Iron and Carbon Steels; flow sheet for production of iron and steel; Iron ores – Pig iron.
5 <sup>TH</sup>	1 <sup>st</sup>	Classification, composition and effects of impurities on iron; Cast Iron: classification, composition, properties and uses.
	2 <sup>nd</sup>	Wrought Iron: properties, uses/applications of wrought Iron.
	3 <sup>rd</sup>	Comparison of cast iron, wrought iron and mild steel and high carbon steel; standard commercial grades of steel as per BIS and AISI.
6 <sup>TH</sup>	1 <sup>st</sup>	Alloy Steels – purpose of alloying; effects of alloying elements – Important alloy steels.
	2 <sup>nd</sup>	Silicon steel, High Speed Steel (HSS), heat resisting steel.
	3 <sup>rd</sup>	Spring steel,Stainless Steel (SS): types of SS.
7 <sup>TH</sup>	1 <sup>st</sup>	Applications of SS – magnet steel – composition, properties and uses.
	2 <sup>nd</sup>	<b>Non-ferrous metals and its Alloys</b> Properties and uses of aluminum, copper, tin.
	3 <sup>rd</sup>	Lead, zinc, magnesium and nickel.
8 <sup>TH</sup>	1 <sup>st</sup>	Copper alloys: Brasses, bronzes – composition, properties and uses.
	2 <sup>nd</sup>	Aluminum alloys: Duralumin, hindalium.

	3rd	Magnesium – composition, properties and uses.
9 <sup>TH</sup>	1st	Nickel alloys: Inconel, monel, nicPerome – composition.
	2nd	Properties and uses.
	3rd	Anti-friction/Bearing alloys.
10 <sup>TH</sup>	1st	Various types of bearing bronzes - Standard commercial grades as per BIS/ASME.
	2nd	<b>Failure analysis &amp; Testing of Materials</b> Introduction to failure analysis.
	3rd	Fracture: ductile fracture, brittle fracture; cleavage; notch sensitivity.
11 <sup>TH</sup>	1st	Fatigue; endurance limit; characteristics of fatigue fracture.
	2nd	Variables affecting fatigue life; creep; creep curve; creep fracture.
	3rd	Destructive testing: Tensile testing; compression testing;
12 <sup>TH</sup>	1st	Hardness testing: Brinell, Rockwell; bend test; torsion test;
	2nd	Fatigue test; creep test. Non- destructive testing.
	3rd	Visual Inspection; magnetic particle inspection.
13 <sup>TH</sup>	1st	Liquid penetrant test; ultrasonic inspection; radiography.
	2nd	<b>Corrosion &amp; Surface Engineering</b> Nature of corrosion and its causes; Electro chemical re-actions; Electrolytes.
	3rd	Factors affecting corrosion: Environment, Material properties and physical conditions.
14 <sup>TH</sup>	1st	Types of corrosion; Corrosion control: Material selection, environment control and design.
	2nd	Surface engineering processes: Coatings and surface treatments; Cleaning and mechanical finishing of surfaces.
	3rd	Organic coatings; Electroplating and Special metallic plating.
15 <sup>TH</sup>	1st	Electro polishing and photo- etching ;– Conversion coatings: Oxide, phosphate and chromate coatings.
	2nd	<b>Thin film coatings: PVD and CVD; Surface analysis; Hard-facing, thermal spraying and high- energy processes.</b>
	3rd	Process/mate-rial selection. Pollution norms for treating effluents as per standards.