

GOVERNMENT POLYTECHNIC JAJPUR

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DEPARTMENT OF METALLURGY

Discipline: Metallurgy	Semester: 4th	Name of the Teaching faculty: Rakesh Kumar Sahu
Subject: Physical Metallurgy	No of Days/Week class allotted: 3	Semester from Date: 22/12/25 To Date: 18/04/26 No of weeks: 15
Week	Class Day	Topics
1st	1 st	Unit-1 : Basic Concepts of Physical Metallurgy : Introduction to Metallurgy
	2 nd	Classification of materials: Metals, alloys, ceramics, polymers, composites
	3 rd	
2nd	1 st	Structure of metals: Atomic bonding, metallic bonding
	2 nd	Imperfections in Solids: Point defects: Vacancies, interstitials, substitutional defects
	3 rd	
3rd	1 st	Line defects: Edge and screw dislocations,
	2 nd	Surface defects: Grain boundaries, twin boundaries, volume defects
	3 rd	Doubt clearing class on Unit-1
4th	1 st	Class Test -1
	2 nd	Unit-2 : Solid Solutions & Solidification of pure metals & alloys
	3 rd	Solid Solutions: Solid solutions (substitutional, interstitial)
5th	1 st	Hume-Rothery rules
	2 nd	Intermediate phases
	3 rd	Solidification of pure metals & alloys : Alloys and solid solution
6th	1 st	Solidification and crystallization
	2 nd	Role of free energy thermodynamic potential in conversion of liquid to solid
	3 rd	Super cooling, under cooling, degree of super cooling
7th	1 st	Mechanism of solidification/ crystallization
	2 nd	Nucleation, critical size nucleus
	3 rd	Spontaneous nucleation
8th	1 st	Relation between nucleation and grain growth
	2 nd	Shape of crystals and solidification of ingot
	3 rd	Remedial class on Unit-2
9th	1 st	Class test-2
	2 nd	Unit-3 : Phase Diagrams & Phase Transformations: Introduction
	3 rd	Phase Rule: Definitions of phase, component, degree of freedom the phase rule and its applications
10th	1 st	Unary Phase Diagrams: Pressure-temperature diagrams for pure substances
	2 nd	Binary Phase Diagrams: Interpretation of binary phase diagrams
	3 rd	Eutectic, Peritectic, Eutectoid, Peritectoid diagrams

11th	1 st	Lever rule & related numericals
	2 nd	Equilibrium and non-equilibrium cooling
	3 rd	Iron carbon diagram & related concept
12th	1 st	Unit-4 : Alloys and Their Properties Ferrous Alloys: Plain Carbon Steels: Classification based on carbon content, their properties and applications
	2 nd	Alloy Steels: Effects of alloying elements (Ni, Cr, Mo, V, W, Mn, Si) on properties
	3 rd	Classification of alloy steels, applications, stainless and special steels
13th	1 st	Cast Irons: Types of cast irons (grey, white, ductile, malleable), their microstructure, properties, and applications
	2 nd	Non-Ferrous Alloys: Aluminum Alloys: Common aluminum alloys, their properties, and applications
	3 rd	Copper Alloys: Brass, bronze, cupronickel, their properties, and applications
14th	1 st	Other Non-Ferrous Alloys: Brief overview of titanium alloys, nickel alloys, etc.
	2 nd	Superalloys, shape memory alloys – classification, properties and applications
	3 rd	Doubt clearing class on all units
15th	1 st	Previous years questions answer discussion
	2 nd	Very Similar Test(VST)-1 to Semester questions
	3 rd	VST-2

Ramesh M. Sahu
 22/12/25
 Signature of the Faculty

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 Signature of HOD