

GUJARAT TECHNOLOGICAL UNIVERSITY

Diploma in Metallurgy Engineering

Semester: 3

Subject Code

Subject Name PHYSICAL METALLURGY – I

Sr. No.	Course content
	INTRODUCTION : 1.1 Introduction and relevance of the subject. 1.2 Division of metallurgy like extractive metallurgy, adaptive metallurgy. 1.3 Difference of metals and non-metals.
	CRYSTALLINE STRUCTURES OF METALS AND BONDS MODELS : 2.1 Define lattice, unit cell, space lattice, crystal, grain etc. 2.2 Structure of atoms like proton, neutron, electron. 2.3 Types of crystal structure like BCC, FCC, HCP. 2.4 Types of bonding like primary and secondary.
	COOLING CURVES : 3.1 Mechanism of cooling. 3.2 Different types of structures like dendritic etc. nucleation and grain growth. 3.3 Structure of ingots. 3.4 Types of solid solution. 3.5 Define cooling curves. 3.6 Types of cooling curves
	EQUILIBRIUM DIAGRAM : 4.1 Construction of equilibrium diagram from cooling curves. 4.2 Application of phase rule, lever rule. 4.3 Types of equilibrium diagrams. 4.4 Information obtained from equilibrium diagram. 4.5 Examples of binary equilibrium diagram. Cu-Zn, Cu-Tin, Fe-C, Al-Si, Pb-Sn etc. 4.6 Allotropic forms of iron.
	MECHANICAL DEFORMATIONS OF METALS : 5.1 Definition of various properties: Mechanical and technological. 5.2 Mechanism of deformation-like elastic & plastic. 5.3 Lattice imperfection and strength of metals. 5.4 Strain hardening. 5.5 Recovery, Recrystallisation and grain growth process.

	METALLOGRAPHY : 6.1 Micro & Macro examination. 6.2 Study of microscope. 6.3 Preparation of micro-specimen
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LABORATORY EXPERIENCES :

1. Construct equilibrium diagram from given data.
 - a. Eutectic equilibrium diagram
 - b. Solid solution equilibrium diagram
 - c. Partially solid solution equilibrium diagram
2. Calculate percentage of micro constituents with the help of Lever rule (Fe-C diagram, Cu-Ni diagram, Brass, Bronze, Sb-Sn diagram etc.)
3. Identify and understand various parts of optical metallurgical microscope.
4. Prepare the micro specimen for Non Ferrous metals and alloys for microscopic examination.
5. Prepare the micro specimen for Ferrous metals and alloys for microscopic examination.
6. Study the metallic crystal structure.
7. Perform the Macro-etching and super-printing for steel.

Reference Books:

1. Engineering physical metallurgy Vol I/II by R.A.Higgins
2. Physical metallurgy for engineers by Clark-Varney
3. Physical metallurgy by Rollason
4. Metallographic lab practice by Kehl
5. Physical metallurgy by Lakhtin
6. Physical metallurgy by Bailey
7. Physical metallurgy by Ragawan
8. Physical metallurgy by Read Hill