

EXTRACTIVE METALLURGY

Course Type	Course Code	Name of Course	L	T	P	Credit
DC	FMC302	Extractive Metallurgy	3	0	0	9

Course Objective

Introduction to unit processes used in the pyro/hydro/electro-metallurgical extraction of metals from ore concentrates

Learning Outcomes

- Understanding of fundamentals used for the extraction of metals from different ores.
- Understanding of basic differences between different type of ore and their extraction processes.
- Unit processes and operations used in the pyro/hydro-metallurgical processing of ore concentrates for extraction and purification of metals.
- Typical flow sheets of some important metal extraction.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Introduction of different types of ores. A brief introduction to pyro/hydro-metallurgy. Understanding of criteria for selecting an extraction method.	3	Understanding of different kinds of ores and their extraction processes.
2	Gas-solid reactions; shrinking core model; calcination, roasting, agglomeration, reduction reactions	8	Preliminary pyro processing of concentrate for subsequent pyro/hydro metallurgy unit operations
3	Smelting; matte smelting; flash smelting; converting; zone refining; fractional distillation; blast furnace, different zones in blast furnace, vacuum/inert-gas degassing;	15	Fundamentals of Pyrometallurgy and unit operations used for the extraction and refining of metals from concentrate
4	Leaching; types of leaching, Eh-pH diagrams and their usefulness, chemical precipitation; cementation, solvent extraction; ion exchange; aqueous and molten salt electrowinning; electro refining; gaseous reduction of metals	12	Fundamentals of hydrometallurgy and unit operations used for recovery of metals from aqueous solution and molten salts
5	Typical flow sheets for extraction of metals such as copper, aluminum, magnesium	4	Examples of flow sheets for the extraction of important metals
	Total	42	

Text Books:

S. No.	Resource/Book Name	Author(s)/Editor(s)	Publisher
1	Process Selection in Extractive Metallurgy	Peter C. Hayes	Hayes Publishing
2	Extraction of Nonferrous Metals	H. S. Ray, R. Sridhar, K. P. Abraham	Affiliated East-West Press
3	First Course in Iron and Steel Making	Deipak Mazumdar	Universities Press
4	Unit Operations of Chemical Engineering	Warren L. McCabe, Julian C. Smith, Peter Harriott	McGraw Hill