

5 th Semester	RML5D001	Principles of Extractive Metallurgy	L-T-P 3-0-0	3 Credits
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MODULE I**(6 HOURS)**

Unit processes in Pyrometallurgy: Calcination and roasting, sintering, smelting, converting, reduction, smelting-reduction, metallothermic and hydrogen reduction.

MODULE II**(8 HOURS)**

Distillation and other physical and chemical refining methods: Fire refining, Zone refining, Liquation and Cupellation. Small problems related to pyro-metallurgy.

MODULE III**(10 HOURS)**

Unit processes in Hydrometallurgy: Leaching practice: In situ leaching, Dump and heap leaching, Percolation leaching, Agitation leaching, Purification of leach liquor, Kinetics of Leaching; Bioleaching: Recovery of metals from Leach liquor by Solvent Extraction, Ion exchange, Precipitation and Cementation process.

MODULE IV**(6 HOURS)**

Importance of potential-pH diagram.

Some process flow sheet: recovery of Au from leach liquors, recovery of Nickel and Cobalt
Small problems relate to hydrometallurgy

MODULE V**(10 HOURS)**

Unit Process in Electrometallurgy: Faraday's Laws of Electrolysis, concept of overvoltage, limiting current density, total cell voltage, series and parallel electrical circuits in refining, aqueous and fused salt electrolysis, electro refining of common metals like Cu, Zn, Au, Ni, Al, Mg etc. Electroplating
Small related problems to Electrometallurgy

Books:

- [1] Ahindra Ghosh and H. S. Ray, Principles of Extractive Metallurgy
- [2] L. Coudurier, D. W. Hopkins and I. Wilkomirsky, Fundamentals of Metallurgical Processes
- [3] R. D. Pehlke, Unit Processes of Extractive Metallurgy

Digital Learning Resources:

Course Name: Non-ferrous Extractive Metallurgy
 Course Link: <https://nptel.ac.in/courses/113/105/113105021/>
 Course Instructor: Prof. H.S. Ray, Department of Materials and Metallurgical Engineering, IITKharagpur