

PMT3I001 Principles of Extractive Metallurgy

Module I (14 hours)

Unit processes in Pyrometallurgy: Calcination and roasting, sintering, smelting, converting, reduction, smelting-reduction, metallothermic and hydrogen reduction; distillation and other physical and chemical refining methods: Fire refining, Zone refining, Liquefaction and Cupellation. Small problems related to pyro metallurgy.

Module II (14 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; Bio-leaching; Recovery of metals from Leach liquor by Solvent Extraction, Ion-exchange, Precipitation and Cementation process. 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 III (12 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 for Reference:

1. *Principles of Extractive Metallurgy* by T. Rosenqvist.
2. *Principles of Extractive Metallurgy* by Ahindra Ghosh and H. S. Ray.
3. *Unit Processes of Extractive Metallurgy* by R. D. Pehlke.
4. *Fundamentals of Metallurgical Processes* by L. Coudurier, D. W. Hopkins and I. Wilkomirsky.
5. *Metallurgical Problems* by A. Butts.
6. *Electrochemical Engineering* by C. L. Mantell.
7. *Principles of Mineral Dressing* by A. M. Gaudin.
8. *Text Book of Ore Dressing* by R. H. Richards and C. E. Locks. *Element of Ore Dressing* by A.E. Taggart.
9. *Handbook of Mineral Dressing- Ores and Industrial Minerals* by A.E. Taggart.
10. *Textbook of Ore Dressing* by S.J. Trusscott.
11. *Ore Dressing* by S.K. Jain.
12. *Mineral Processing Technology* by Berry A Willis.