

B. Tech (Metallurgical & Materials) Syllabus from Admission Batch 2018-19
5th Semester

5th Semester	RMM5D006	Non Ferrous Extractive Metallurgy	L-T-P 3-0-0	3 Credits
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Module I: **(8 Hours)**

Fundamentals of Unit processes involved in Metal Extraction. Thermodynamic considerations and process selection in Pyro-metallurgical extraction of metals. Kinetics of leaching of ores; effect of various operating variables on leaching process; bio leaching.

Module II: **(8 Hours)**

Principles involved in Electro-metallurgical extraction of metals.

Extraction of metals from oxide ores (Sn, Mg).
Extraction of metals from Sulphide ores (Cu, Ni, Pb and Zn)

Module III: **(8 Hours)**

Extraction of metals through halide route (Ti and Zr)
Refining involving oxidation, chemical transport reactions, zone refining, distillation, etc.
Ion exchange and solvent extraction processes and their application in extraction processes (Zr, V, Th, Nb, etc)

Module IV: **(8 Hours)**

Electro winning and Electro refining of metals:

- a) From aqueous salts (Cu, Ni, Au, Ag)
- b) From fused salts (Al and Mg)

Module V: **(8 Hours)**

Sustainable Chemical Metallurgy, Recycling and Recovery from waste.
Environmental pollution and its address related to various metal extraction processes in general.

Books:

- [1] Extraction of Non Ferrous Metals by H.S.Ray, R.Sridhar&K.P.Abraham, Affiliated East – West Press, New Delhi
- [2] Extraction and Refining of Metals, by C. Bodsworth, CRC Press
- [3] Metallurgy of Non Ferrous Metals by W.H.Dennis, Pitman.
- [4] Principles of Extractive Metallurgy, by T. Rosenquist, McGraw hill, 1974
- [5] Rare Metal Extraction by Chemical Engg. Tech. by W.D.Jamrack, Pergamon Press, Oxford.

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Digital Learning Resources:

Course Name: Non-ferrous Extractive metallurgy
Course Link: <https://nptel.ac.in/courses/113/105/113105021/>
Course Instructor: Prof. H.S. Roy, IIT KGP