GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3152107
Subject Code: 3152107
Semester – V

Subject Name: Non Ferrous Extractive Metallurgy

Type of course: Engineering/science

Prerequisite: Knowledge of Mineral Processing, Metallurgical Thermodynamics Principles.

Rationale: Non ferrous extractive Metallurgy subject will prepare students for careers in Engineering where they have to manage the processes of mineral dressing, concepts of thermodynamics and kinetics to different processes for extraction of metals, metal extraction and refining of non ferrous metals. This education at the undergraduate level will enable students to seek employment in Metal Industries upon graduation while at the same time, provide a firm foundation for the pursuit of graduate studies in Metallurgy Engineering.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	0	4	70	30	00	00	100

Content:

Sr. No.	Content	Total Hrs
1	Basic principles of extractive metallurgy - Thermodynamics and kinetics of extraction processes.	6
2	Thermodynamic basis of metal extraction: Ellingham diagrams, predominance area diagrams, Pourbaix diagrams, concept of activity and activity scales.	8
3	Kinetics of extraction process: kinetic theory, reaction rate theory, reaction across interfaces	8
4	Hydrometallurgy, Electro metallurgy, Pyrometallurgy: Basic principle, Types, Advantages and limitations of Different extraction Processes and beneficiation.	8
5	Extractive metallurgy of Al, Cu, Zn, Pb, Sn, Ni, Ti, and Mg metals.	26

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level

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25%	**35%**	**25%**	**10%**	**5%**	**0%**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Suggested Books:

1. The Extraction and Refining of Metals, C. Bodsworth, CRC Press (1994).
2. Principles of Extractive Metallurgy, H.S. Ray and A. Ghosh (1992), Wiley-Blackwell
3. Extractive Metallurgy by Joseph Newton, Pub.- John Wiley & Sons
4. Metallurgy of the Non ferrous metals, by W.H. Dennis, Pitman, London 1963
5. Principles of Extractive Metallurgy., T. Rosenquist, McGraw Hill
6. Extractive Metallurgy 1: Basic Thermodynamics and Kinetics, Alain Vignes (ISTE Ltd.,)
7. Extractive Metallurgy 2: Metallurgical Reaction Processes, Alain Vignes (ISTE Ltd.,)\
8. Extractive Metallurgy 3: Processing Operations and Routes, Alain Vignes (ISTE Ltd.,)
9. Topics in non-ferrous extractive metallurgy, Burkin, Wiley-Blackwell (1980)

Course Outcomes
After completing this course, students will able to,

Sr. No.	CO statement	Marks % weightage
CO1	Understand principles of thermodynamics and kinetics to reaction involving extraction of metals	40
CO2	Compare Pyro metallurgy and Hydro metallurgy processes.	30
CO3	Analyze different non ferrous metals extraction processes.	30

List of Open Source Software/learning website:

I. http://nptel.iitm.ac.in/
II. www.ocw.mit.edu