GUJARAT TECHNOLOGICAL UNIVERSITY

METALLURGY ENGINEERING
Extraction of Non Ferrous Metals
SUBJECT CODE: 2152107
B.E. 5th SEMESTER

Type of course: Engineering Science

Prerequisite: Mineral Processing, Knowledge of Metallurgical Thermodynamics Principles, Knowledge of Principle of Extractive metallurgy

Rationale: Extraction of non ferrous metals subject will prepare students for careers in Engineering where they have to manage the processes of mineral dressing, metal extraction and refining of non ferrous metals. This subject provides information about different processes of extraction of non ferrous metals and their refining which will be useful for effective management in industry. 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
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	0	0	4	70	20	10	0	0	0	100

Content:

Sr. No.	Content	Total Hrs	% W
1	**General:** World and Indian scenario of important non-ferrous ores and mineral deposits. Non-ferrous metallurgical industry in India.	4	7
2	**Aluminium:** Applications, Extraction of Aluminium: Bayer's process for production of alumina. Hall-Heroult process, synthesis of Cryolite, electrolytic reduction cell, Electrolytic refining of aluminium. Methods for treating low grade ores. Newer process for Aluminium production: ALCOA Process, TOTH Process, ALCAN Process. Aluminium production in India.	12	20
3	**Copper:** Applications, Pyrometallurgical extraction of copper, Refining of copper, Recovery of Precious metals from Anode slime. Newer process for Copper extraction: Flash smelting, WOCRA Process, Noranda Process, Mitshubishi Process, TORCO Process. Hydrometallurgical process for production of primary copper. Copper production in India.	12	20
4	**Nickel:** Applications, Pyro metallurgical extraction of Nickel: Extraction of Nickel from sulphide and oxide ores. Hydro metallurgical extraction of Nickel. **Lead:** Applications, Extraction of lead. Modern development in lead smelting. L production in India. **Zinc:** Applications, Pyro metallurgical and Hydro metallurgical extraction of zinc. Imperial smelting process. Zinc from lead slag by slag fuming. Zinc production in India. Treatment of complex sulphide of lead, copper and Zinc. **Tin:** Applications, Extraction and Refining of Tin. **Magnesium:** Applications, Extraction and refining of magnesium: Pidgeon Process. Magnesium production in India.	22	37
5	**Precious metals: Gold, Silver and Platinum:** Properties and Applications of	10	16

	precious metals. Various extraction methods for production of gold and silver. Gold and silver Extraction in India. Extraction of Platinum group metals. Recovery of gold, silver and platinum from secondary sources.		

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	**30**	**30**	**10**	**5**	**5**

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.

Reference Books:

1. Extraction of Non-ferrous Metals, H. S. Ray, R. Sridhar and K. P. Abraham, Affiliated East-West Press.
2. Principles of Extractive Metallurgy -A. Ghosh and H. S. Ray, John Wiley & Sons.
3. Extractive Metallurgy by Joseph Newton, John Wiley & Sons.
4. Principles of Extractive Metallurgy., T. Rosenquist, McGraw Hill
5. Metallurgy of the Non ferrous metals, by W.H. Dennis, Pitman, London 1963.

Course Outcome:

After learning the course the students should be able to:

1. Understand about Extractive metallurgy processes and their relative merits and demerits.
2. Understand different non ferrous metals extraction processes.
3. Know flow sheets of extraction of different non ferrous metals.

List of Open Source Software/learning website:

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

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.