GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

NON-FERROUS PRODUCTION METALLURGY
(Code: 3332103)

Diploma Programmes in which this course is offered	Semester in which offered
Metallurgy Engineering	3rd Semester

1. RATIONALE

Diploma pass outs have to work in industries where in they have to manage the processes of mineral dressing, metal extraction and refining of non ferrous metals. Such a responsibility desires deep knowledge of mineral dressing, metal extraction processes and related metal refining processes. This subject provides information about mineral dressing, extraction of non ferrous metals, and refining thereafter for various metals, which will be useful for effective management in industry.

2. COMPETENCY (Programme Outcome according to NBA Terminology)

The course content should be taught and with the aim to develop different types of skills so that students are able to acquire following competency:

- **Use mineral dressing, metal extraction and refining processes for production of various non-ferrous metals.**

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
4	0	0	4	70	30	-	-	100

Legends: L - Lecture; **T -** Tutorial/Teacher Guided Student Activity; **P -** Practical; **C -** Credit; **ESE** - End Semester Examination; **PA** - Progressive Assessment

4. COURSE DETAILS

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Unit – I Metallurgy and Mineral Dressing	1a. Explain concept of metallurgy 1b. Describe the need of mineral dressing	1.1 Metallurgy: classification 1.2 Mineral dressing: concept, Processes, need & importance
	1c. State the criteria of economic production of non-ferrous metal with reference to ore valuation	1.3 Ores and minerals: composition, gangue, richness, location, cost of production 1.4 Mineral Dressing: Calcinations, roasting, types of fluxes.
Unit – II Ore concentration Process	2a. Describe purposes of ore sizing. 2b. Explain different kinds of crushers. 2c. Justify the need for different kinds of mills. 2d. Describe the features of different kinds of sieves.	2.1 Purposes of ore sizing 2.2 Ore crushing equipment: Working, operation and Maintenance of jaw crusher, gyratory crushers, 2.3 Ore grinding equipment- working, operation & maintenance of Ball Mills, Pebble mill & Rod Mill 2.4 Critical velocity of ball mill 2.5 Close circuit ball mill 2.6 Sieves, vibrating sieves, rod sieves
	2e. Explain various ore concentration processes with operation and maintenance of equipment.	2.7 Ore concentration processes: working principle, operation and maintenance of equipment of Jigging , Tabling process, Magnetic separation, flotation cell, and Wet cyclone
	2f. Describe dewatering and agglomerations. 2g. Select the mineral dressing operation for producing concentrated ore.	2.8 Method of dewatering 2.9 Agglomeration
Unit – III Production of copper and aluminium metal	3a. State different types of extraction processes 3b. Describe the extraction of copper from its ore.	3.1. Metal extraction processes: Concepts and comparisons of Pyro metallurgy, hydro metallurgy and electro metallurgy 3.2. Production of copper from its ore, and its flow diagram. 3.3. Copper alloys: different alloys, its composition and uses.
	3c. Describe the extraction of aluminium from its ore.	3.4. Production of aluminum from its ore and its flow diagram
Unit – V Production of lead, tin and zinc metal	5a. Describe the extraction of lead from its ore, and refining of lead.	5.1 Production of lead from its ore and its flow diagram. 5.2 Softening of lead and de silverisation
	5b. Describe the extraction of zinc from its ore 5c. Describe the extraction of tin from its ore	5.1 Production of zinc from its ore and its flow diagram. 5.2 Production of tin from its ore and its flow diagram.

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Unit – VI Production of uranium	6a. Describe the extraction of uranium from its ore.	6.1 Nuclear metal 6.2 Extraction of uranium from its ore 6.3 Application of uranium.

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (Theory)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to metallurgy and mineral dressing	08	04	02	01	07
II	Ore concentration process	18	13	05	02	20
III	Production of copper and aluminium metal	12	10	05	03	18
IV	Production of lead, tin and zinc metal	12	10	05	03	18
V	Production of uranium	06	04	02	01	07
Total		**56**	**41**	**19**	**10**	**70**

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised 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.

6. SUGGESTED LIST OF EXERCISES/PRACTICALS

Not Applicable

7. SUGGESTED LIST OF STUDENT ACTIVITIES

i. Visit websites of the metal extracting companies and study the various technologies being employed by them.

ii. Visit nearby industry engaged in metal extracting (if any) and study the processes being used.

8. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

i. Display of charts and videos

ii. Display of Videos and animation,

ii. Internet based assignments,

iii. Visit to industries.

9. SUGGESTED LEARNING RESOURCES

A) List of Books

S. No.	Title of Books	Author	Publication
1	Principle of extractive metallurgy	H.S.Ray & Ghosh	East West Press Pvt. Ltd., New Delhi, 1990,
2	Principle of mineral dressing	A.M.Gaudin	Tata Mc-Graw Hill Publishing Co. Ltd. New Delhi, 1991
3	Elements of metallurgy	D.Swarup and M. N. Saxena	Rastogi Publications, Kolkota, Dec-2005
4	Metallurgy of the Non ferrous metals	W.H.Dennis	Pitman, London 1963

B) List of Major Equipment/Materials with Broad Specifications

Not applicable.

C) List of Software/Websites

i. www.iitk.ac.in/nptel

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. V.C. Patel**, H.O.D, Department of Metallurgy, L.E.College, Morbi
- **Prof. S.F. Parmar**, Lecturer, Department of Metallurgy, L.E.College, Morbi

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. C. K. Chugh**, Professor, Department of Mechanical Engineering
- **Prof. Sharad Pradhan**, Associate Professor and Head Department of Mechanical Engineering