GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3172207
Semester – VII
Subject – Mineral Processing

Type of course: Professional Elective Course

Prerequisite: Zeal to learn the subject

Rationale: This subject helps students to understand the process involved in ore beneficiation of the mined out ore. The student also understands the process followed after mineral exploitation is done.

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)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Introduction:** Scope, Objectives and limitations of ore/mineral processing. Terminologies, Beneficiation, Mineral beneficiation and its operations.	3
2	**Liberation:** Concept, importance and measurements of liberation. **Comminution:** Fracture, laws, objectives and types of comminution. **Crushing:** Crushing operations, Open and close circuit operations, types of crushers. **Grinding:** wet and dry grinding, grinding circuits, and types of mills.	8
3	**Sample:** Importance; methods used; sampling process. **Sizing:** Laboratory sizing techniques, testing methods, interpretation of data, Industrial sizing by screens. **Screening:** Purpose, screen surface, types, factors affecting on screening, screen efficiency. **Classification:** classifiers, sizing classifiers, sorting classifiers and centrifugal classifiers.	8
4	**Gravity Concentration Method:** Float and sink, heavy media separation, jigging, flowing film concentration	4

5	**Froth flotation:** Physico-chemical principles, reagents, types, machines, flotation operation, and column flotation, flotation practice of sulphide ores, oxide and coal.	**4**
6	**Magnetic concentration/separation:** Principles, magnetism, electro-magnetism, magnetic separators, **Electric Concentration/separation:** charge and charge interaction, methods of charging, electrostatic separation, separators. **Solid – Liquid separation or Dewatering:** Thickening, filtration with its types.	**8**
7	**Plant Practices:** Locations, layouts and selection of equipment **Simplified processing/ beneficiation flow sheets:** Beneficiation of coal, copper, aluminum, lead, zinc, iron, silver, gold, uranium, manganese, limestone reference to Indian deposit.	**6**
8	**Environmental Issue:** Drying and disposal of tailing, associated environmental problems and their control, utilization of waste disposals.	**4**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15%	**45%**	**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.

Reference Books:

1. Wills, B.A., Mineral Processing Technology; Pergamon Press – 4th sEdition, 1989.
2. S.M.E., 1985. Maurice C. Fuerstenau , Edited by Kenneth N. Han , Principles of Mineral Processing, Society for Mining, Metallurgy, and Exploration , United States, 2003.
3. Ashok Gupta, Denis S. Yan., Mineral Processing Design and Operations: An Introduction, Elsevier Science & Technology, Oxford, United Kingdom, 2016.
4. G S Ramakrishna Rao, Mineral Processing Techniques Basics and Related Issues, Zorba Publishers, India, 2014.

5. F. Taggart, Mineral Dressing Handbook, P & H, 2000
6. B. A. Wills, Mineral Processing Technology, Willy & Sons, 2005
7. G. C. Lowrison, Crushing & Grinding, Maxwell and MacMillan, 2002
8. L. Svalovsky, Solid Liquid Separation, Tata McGraw & Hill Inc., 2003

Text Books:

1. A. M. Gaudin, Principles of Mineral Dressing, Tata McGraw & Hill, 1939
2. R. H. Richard and C. E. Locky, A text Book on Ore Dressing, A A Balkema, 2004
3. D. V. Subbarao, Mineral Beneficiation, CRC Press, 2011.
4. S. K. Jain, Ore Processing, Oxford, 1990

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Apply mineral processing principles in the mineral processing plant for ore beneficiation.	33%
CO-2	Select appropriate equipment, machinery and process required for ore beneficiation	34%
CO-3	Dispose waste generated during ore beneficiation process	33%

List of Experiments:

Following experiments are suggested for laboratory work:

1. Sampling: a) Coning and quartering b) Riffle Sampling
2. To perform a Sieve analysis and do the interpretation of data.
3. Determination of actual capacity of a jaw crusher.
4. Determination of actual capacity of a roll crusher.
5. Determination of grindability index of the given ore.
6. Separation of heavier particles from the given feed using mineral jig and calculation of ratio of concentration.
7. Study of the particle movement on the deck of an operating table.
8. Separation of ferrous minerals using magnetic separator.
9. Study of the flotation characteristics of the copper ore/ zinc and lead ore/coal.

Major Equipment:

1. Laboratory model of Jaw Crusher
2. Laboratory model of Gyratory Crusher
3. Laboratory model of Cone Crusher
4. Laboratory model of Ball Mill
5. Laboratory model of Rod Mill
6. Laboratory model of Sieve Shaker with different sieve sizes.
7. Weighing machine
8. Laboratory model of Jigging machine
9. Froth Flotation machine
10. Laboratory model of Magnetic Separator
11. Laboratory model of Heavy media separation chamber
12. Laboratory model of Will Fly Tables
13. Laboratory model of Cyclone

List of Open Source Software/learning website:

1. https://nptel.ac.in/courses/105/105/105105171/
2. https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-ce14/
3. https://www.mdpi.com/journal/minerals/sections/Mineral_Processing
4. https://www.youtube.com/watch?v=9bF67C7vnm8&ab_channel=nptelhrd
5. https://www.youtube.com/watch?v=aj6otFQMUvA&ab_channel=GIAN-MHRD%2CIITKharagpur

Active Learning Assignment:

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.