

Enrollment No./Seat No.:

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**Bachelor of Engineering - SEMESTER - III EXAMINATION - WINTER 2025**

**Subject Code: BE03021021**

**Date: 17-12-2025**

**Subject Name: Introduction to Mineral Processing & Extractive Metallurgy**

**Time: 10:30 AM TO 01:00 PM**

**Total Marks: 70**

**Instructions**

- 1. Attempt all questions.**
- 2. Make suitable assumptions wherever necessary.**
- 3. Figures to the right indicate full marks.**
- 4. Simple and non-programmable scientific calculators are allowed.**

|                                                                                                                                                                                        | <b>Marks</b> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Q.1 (a)</b> Define Liberation and explain its significance in mineral processing.                                                                                                   | <b>03</b>    |
| <b>(b)</b> Explain the physical and chemical characteristics of industrial minerals with respect to Iron and Copper ores.                                                              | <b>04</b>    |
| <b>(c)</b> Differentiate between Crushing and Grinding operations with suitable examples of equipment used in each.                                                                    | <b>07</b>    |
| <b>Q.2 (a)</b> List the different variables in the froth flotation process.                                                                                                            | <b>03</b>    |
| <b>(b)</b> What is Jigging? Explain its principles and applications.                                                                                                                   | <b>04</b>    |
| <b>(c)</b> Draw and briefly explain a simplified beneficiation flow sheet for a Copper ore deposit.                                                                                    | <b>07</b>    |
| <b>OR</b>                                                                                                                                                                              |              |
| <b>(c)</b> Select a suitable separation process for a material that has a significant difference in specific gravity between the valuable mineral and the gangue. Justify your choice. | <b>07</b>    |
| <b>Q.3 (a)</b> Explain the difference between Electrowinning and Electrorefining processes in extractive metallurgy.                                                                   | <b>03</b>    |
| <b>(b)</b> Define the following terms in the context of pyrometallurgy: Calcination and Sintering.                                                                                     | <b>04</b>    |
| <b>(c)</b> Explain the principle and working of froth flotation technique with neat sketch. List the various physico-chemical principles of floatation.                                | <b>07</b>    |
| <b>OR</b>                                                                                                                                                                              |              |
| <b>(a)</b> Describe the role of oxygen in the leaching process during hydrometallurgy.                                                                                                 | <b>03</b>    |
| <b>(b)</b> Name and briefly describe two types of Leaching techniques used in hydrometallurgy.                                                                                         | <b>04</b>    |
| <b>(c)</b> Draw a simplified diagram of Blake Jaw Crusher showing different parts. Explain the factors affecting its operation.                                                        | <b>07</b>    |
| <b>Q.4 (a)</b> If the coefficient of friction between the rock and steel is 0.5, what is the minimum diameter of the roll to reduce 5.5 cm pieces of rock to 1.5 cm.                   | <b>03</b>    |
| <b>(b)</b> What is the role of mineral processing in extractive metallurgy? Discuss.                                                                                                   | <b>04</b>    |

- (c) Explain the working principle of Ion Exchange and Solvent Extraction used in hydrometallurgy. 07

**OR**

- (a) If crushing rolls of 100 cm diameter are set so that the crushing surfaces are 1.3 cm apart and angle of nip is  $31^\circ$ . What is the maximum size of particles which should be fed to the rolls ? 03

- (b) Enlist and briefly describe the different types of screens used in industrial screening. 04

- (c) Explain hydrometallurgy and list out the merits and demerits of hydrometallurgy. 07

- Q.5** (a) Describe the difference between a sizing classifier and a sorting classifier. 03

- (b) Explain the theory of ball mill operation along with its different zones with a neat sketch. 04

- (c) Explain the principle of magnetic separation and mention the process description. 07

**OR**

- (a) Explain the terms ore, mineral and gangue. 03

- (b) Draw the flowsheet showing basic steps in Mineral Processing. Explain the need of each step. 04

- (c) Draw a figure of roll crusher and derive a relation between friction co-efficient and angle of nip. 07

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