



# GUJARAT TECHNOLOGICAL UNIVERSITY

**Program Name: Bachelor of Engineering**

**Level: UG**

**Branch: Mining Engineering**

**Subject Code: BE05022041**

**Subject Name: Bulk Material Handling**

w. e. f. Academic Year:	2024-25
Semester:	5
Category of the Course:	Professional Elective Course - 1

<b>Prerequisite:</b>	Basics of Mining Engineering; Engineering Mechanics
<b>Rationale:</b>	This course provides comprehensive knowledge of bulk material handling systems used in the mining and mineral industries for efficient transportation, storage, loading, and unloading. It emphasizes the principles of material flow, selection and operation of handling equipment, conveyor systems, storage facilities, maintenance practices, and safety measures. Students gain an understanding of modern material-handling technologies, automation systems, and sustainable practices essential to improving productivity, reducing operational costs, and ensuring safe and efficient mining operations.

### Course Outcomes:

Sr. No.	CO statement	Marks% weightage
CO-1	Understand the fundamentals, principles, and importance of bulk material handling systems in mining industries.	15
CO-2	Apply principles of conveyor systems, transportation equipment, and material storage methods in mining operations.	20
CO-3	Analyze the design, selection, and performance of bulk material-handling equipment to ensure efficient material flow.	25
CO-4	Understand maintenance practices, safety measures, and environmental considerations for bulk material handling systems.	20
CO-5	Apply knowledge of automation, modern technologies, and energy-efficient practices in bulk material handling operations.	20

### Teaching and Examination Scheme:

Teaching / Learning Scheme (in Hours per semester)					Total Credits	Assessment Pattern and Marks					Total Marks
L	T	P	SL	Total no of hours per semester		Theory		Tutorial / Practical			
						ESE (E)	PA / CA (M)	PA/CA (I)	TW/SL (I)	ESE (V)	
45	0	30	15	90	3	70	30	20	30	50	200



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**Content:**

Sr. No.	Content	Total Hrs.
1	<b>Introduction to Bulk Material Handling:</b> Scope and importance of bulk material handling in mining industries; characteristics of bulk materials; material flow properties; classification of material handling systems; factors affecting selection of handling equipment; economics of material handling systems.	08
2	<b>Conveyor Systems:</b> Belt conveyors; apron conveyors; screw conveyors; chain conveyors; bucket elevators; design and selection of conveyors; conveyor components; belt tension and power calculation; conveyor capacity; safety devices and maintenance practices.	10
3	<b>Transportation, Loading and Storage Systems:</b> Loading and unloading equipment; hoppers, feeders, stackers, reclaimers, wagon loaders, and ship loaders; storage bins and silos; material blending systems; stockyard management; loading efficiency and operational planning.	10
4	<b>Bulk Material Handling Equipment and Maintenance:</b> Crushers and feeders used in material-handling circuits; transfer points; chute design; dust-suppression systems; maintenance planning; equipment reliability and availability; preventive and predictive maintenance practices.	09
5	<b>Safety, Environment and Modern Trends in Material Handling:</b> Safety practices and statutory regulations; fire and dust hazards in conveyor systems; noise and environmental control; automation and monitoring systems; PLC and SCADA applications; energy-efficient handling systems; smart and sustainable material handling technologies.	04
<b>TOTAL</b>		<b>45</b>

**Suggested Specification table with Marks (Theory): (For B.E. only)**

<b>Distribution of Theory Marks</b>					
R Level	U Level	A Level	N Level	E Level	C Level
<b>30</b>	<b>40</b>	<b>20</b>	<b>10</b>	<b>00</b>	<b>00</b>

**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 the above table.



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The syllabus of Bulk Material Handling directly contributes to:

SDG 4	Quality Education
SDG 8	Decent Work and Economic Growth
SDG 9	Industry Innovation and Infrastructure
SDG 12	Responsible consumption
SDG 13	Climate action

## Reference Books:

Sr. No.	Title	Author(s)	Publisher
1	Belt Conveyors for Bulk Materials	CEMA	Conveyor Equipment Manufacturers Association
2	Bulk Material Handling: Practical Guidance for Mechanical Engineers	Michael Rivkin	Partridge Publishing Singapore
3	Material Handling Equipment	M. P. Alexandrov	MIR Publishers
4	SME Mining Engineering Handbook	Peter Darling	SME Publications
5	Conveyor Belt Engineering	G. Lodewijks	Springer
6	Mine Transportation and Handling Systems	J. A. Deshmukh	Oxford University Press
7	Bulk Solids Handling	C. R. Woodcock	Blackie Academic
8	Belt Conveyors for Bulk Materials	Equipment Manufacturers Association. Engineering	Cbi Pub Co
9	Introduction of Materials Handling	Siddhartha Ray	New Age International
10	Material Handling Equipment	Rudenko	MIR Publishers
11	Materials Handling Handbook	Raymond A. Kulwiec	John Wiley and Sons.
12	Materials Management and Materials Handling	S. C. Sharma	Khanna Publishers
13	Aspects of Materials Handling	K. C. Arora and V. V. Shinde	Laxmi Publishers

## List of Experiments:

1. Study of mine production systems and operational flow charts.
2. Numerical problems on linear programming applications in mining.
3. Productivity analysis of mining equipment.



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4. Cycle time study of truck-shovel combinations.
5. Reliability and availability calculations for mine equipment.
6. Maintenance planning for mining machinery.
7. Simulation study of mine haulage systems.
8. Inventory control applications in mining operations.
9. Network analysis using CPM and PERT techniques.
10. Case study on automation and smart mining systems.

## Major Equipment:

- i. Belt Conveyor Model
- ii. Screw Conveyor Model
- iii. Bucket Elevator Model
- iv. Apron Conveyor Model
- v. Conveyor Belt Tension Setup
- vi. Hopper and Feeder Demonstration Unit
- vii. Crusher and Feeder Model
- viii. Material Flow Testing Apparatus
- ix. Dust Suppression Demonstration Setup
- x. Conveyor Safety Devices
- xi. PLC/SCADA Demonstration Kit
- xii. Stockyard Management Model
- xiii. Computer Systems with Simulation Software
- xiv. Belt Conveyor Idlers and Pulley Setup
- xv. Material Handling Simulation Software

## Open-Source Software/learning website:

1. [NPTEL Engineering Courses](#)
2. [CEMA Resources](#)
3. [SME Mining Resources](#)
4. [Bulk Material Handling Tutorials on YouTube](#)

## List of suggested activities for Problem-based Learning (PBL):

Sr. No.	PBL category	Name of the activity	No. of hours	Evaluation Criteria
1.	Complex Problem-Solving targeting relevant SDGs / Mini Project	Mini Project	10h (need to be changed as per total PBL hours)	Based on the novelty of project, technical understanding, report quality and presentation
2.	Case Study Analysis /	Seminar	15h (need to be	Based on the quality of



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	Seminar		changed as per total PBL hours)	report and presentation, technical understanding
3.	Micro project	Micro project	5h (need to be changed as per total PBL hours)	Based on the novelty of project, technical understanding, quality of report and demonstration
4.	Industry/Research laboratory visit	Industry/Research laboratory visit	Visit = 5h, Report preparation = 5h Total = 10h	Based on report submitted. Report should contain observations and calculations based on industry/ lab data.
5.	Video Based Learning	Technical video-based learning related to the subject	Duration of video = 5h Report preparation = 5h Total = 10h	Report /presentation based on the video learning outcomes.
6.	Assignment / Technical Writing / Research Writing	Assignment writing. Numerical based assignment is preferable.	5 assignments of 4 h each Total = 20h	Based on the correctness of submitted assignment
7.	Group Discussion / Quiz / Simulation	Problem solving/Coding using C, C++, MATLAB, Python, SCILAB, modeling and Analysis software or any other software	5 small coding-based assignment of 2h each Total = 10h	Based on the coding solution submitted.
8.	Video Based Learning	Self-learning online course	Minimum duration of the course should be 10h	Examination based assessment at the end of course. Based on the certificate produced.
9.	Complex Problem-Solving targeting relevant SDGs / Mini Project	Identification and solution of Complex problem	Maximum 2 problems. Study of the problem and solution finding, Total = 10h	Based on the depth of the solution submitted.
10.	Video Based Learning	Videos on Industrial safety/Disaster Management aspects based on subject	Duration of video = 5h Report preparation = 5h Total = 10h	Based on quiz/report submitted
11.	Research Paper Review / Analysis	Technical paper reading and summarization of research papers based on relevant subject	5 research papers = 20h	Summarize research paper and evaluation critical parameters



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12.	Poster / Chart / PowerPoint presentation	Poster/chart/power point preparation on technical topics	Duration = 6h	Based on poster/chart preparation and presentation skills
13.	Industry/Research laboratory visit	Industrial exposure for 2-3 days to observe and provide tentative solutions on society/environment/health/sustainability/any other issue	Duration = 15h for industrial exposure  Problem identification and tentative solution = 10h Total = 20h	Based on evaluation of critical problems and solutions
14.	Group Discussion / Quiz / Simulation	Group Discussion on emerging/trending technical topics based on subject	Duration = 1h – 3h per topic	Based on performance in group discussion, technical depth, knowledge etc.
15.	Case Study Analysis / Seminar	Real world case studies-based learning	Duration of data collection/study = 5h Report preparation = 5h Total = 10h	Based on in-depth study, technical depth, data collected, fact finding, etc.
16.	Group Discussion / Quiz / Simulation	Application/Software development	Duration = 10h	Depending on the complexity of the Application/Software
17.	Assignment / Technical Writing / Research Writing	Research paper publication	Duration = 10h	Based on submission of proof of publication
18.	Micro project	Upgradation/Reverse engineering studies of existing equipment of the laboratory	Duration 10h	Based on the performance of the equipment
19.	Industry/Research laboratory visit	Expert lecture/session	Duration 3h For attending the lecture/session– 2h and for report writing 1h	Based on the proof of attendance and report submitted
20.	Video Based Learning	Annotated Video Explanation of Concept/Problem	10h (Preparation + Recording + Submission)	Based on accuracy of explanation, clarity, and presentation style.
21.	Assignment /	Patent Search and Innovation	10h (Search +	Based on number of



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	Technical Writing / Research Writing	Gap Identification	Report)	relevant patents analyzed and identification of innovation scope.
22.	Assignment / Technical Writing / Research Writing	Preparation of a report on Indian Standard(s)	10h (study of Indian Standard(s) + report	Based on report quality and understanding of the relevant Indian Standard(s).

List of suggested activities for Term Work / Self Learning:

**a. Assignments:** (Seminar Topics/ Visits/Self-Learning Topics) Questions/Problems/Numerical/Exercises to be provided by the course teacher in line with the targeted COs.)

- i. Design a belt conveyor system for a mine.
- ii. Calculate conveyor capacity and power requirement.
- iii. Compare different bulk material handling equipment.
- iv. Analyze safety measures in conveyor systems.
- v. Study automation practices in material handling plants.

**b. Micro Projects:**

A Suggested list of course-wise micro-projects is mentioned herewith

- i. Prepare a layout of a coal handling plant.
- ii. Develop a maintenance schedule for conveyor systems.
- iii. Design a hopper and feeder arrangement for mineral handling.
- iv. Prepare a case study on automated bulk material handling systems

**Note:**

1. Mini Project – 10 Marks , Micro Project – 5 Marks
2. The hours allocated to specific activities should be proportionate to the total no. of PBL hours and marks.

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