



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering

Level: UG

Branch: Mining Engineering

Subject Code: BE05022031

Subject Name: Surface Mining Technology

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

Prerequisite:	Basics of Mining Engineering; Rock Mechanics; Mine Surveying - I
Rationale:	The course provides comprehensive knowledge of surface mining methods, drilling and blasting practices, excavation and haulage systems, mine planning, and environmental management essential for efficient surface mining operations. It emphasizes scientific mine planning, machinery selection, production scheduling, safety practices, and sustainable mining approaches. Students gain an understanding of modern technologies, statutory regulations, and advanced mining systems used in contemporary surface mines for safe, economical, and environmentally responsible mineral extraction.

Course Outcomes:

Sr. No.	CO statement	Marks% weightage
CO-1	Understand the fundamentals, methods, and development aspects of surface mining operations.	15
CO-2	Apply principles of drilling, blasting, excavation, and haulage systems in surface mines.	20
CO-3	Analyze mine planning, production scheduling, and transportation systems for efficient surface mining operations.	25
CO-4	Understand mine planning, environmental management, reclamation, and sustainable mining practices in surface mines.	20
CO-5	Apply knowledge of mine safety, statutory regulations, and modern technologies used in advanced surface mining operations.	20

Teaching and Examination Scheme:

Teaching / Learning Scheme (in Hours per semester)					Total Credits	Assessment Pattern and Marks					Total Marks
L	T	P	PBL	Total no of hours per semester		Theory		Tutorial / Practical			
						ESE (E)	PA / CA (M)	PA/ CA (I)	PBL (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	Introduction to Surface Mining: Scope and classification of surface mining methods; comparison between surface and underground mining; mine development stages; bench parameters; stripping ratio; factors affecting selection of mining methods.	08
2	Drilling, Blasting and Excavation: Types of drills and drilling patterns; explosives and blasting techniques; controlled blasting; excavation and loading machinery such as shovels, draglines, loaders, and excavators; productivity and cycle time analysis.	10
3	Haulage and Mine Planning: Haulage systems in surface mines; dumpers, conveyors, and rail transport; haul road design; mine layout planning; pit optimization; production scheduling; waste dump design and mine drainage.	10
4	Mine Planning and Environmental Management: Surface mine planning and design; ultimate pit limit; production scheduling; waste dump planning; mine drainage and dewatering; environmental impacts of surface mining; reclamation, mine closure planning, and sustainable mining practices.	09
5	Modern Trends, Safety and Technology in Surface Mining: Surface mine safety practices and DGMS regulations; accident prevention and risk assessment; dust and noise monitoring; use of GPS, GIS, remote sensing, drones, automation, AI and IoT in mining operations; smart and sustainable surface mining technologies.	04
TOTAL		45

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

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

R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)



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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.

The syllabus of Surface Mining Technology 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
SDG 15	Life of Land

Reference Books:

Sr. No.	Title	Author(s)	Publisher
1	Surface Mining Technology	S. K. Das	Lovely Prakashan
2	SME Mining Engineering Handbook	Peter Darling	SME Publications
3	Surface Mining	Bruce A. Kennedy	Society for Mining, Metallurgy & Exploration
4	Opencast Mining Systems	Hustrulid & Kuchta	CRC Press
5	Rock Slope Engineering	Duncan C. Wyllie	CRC Press
6	Drilling and Blasting of Rocks	C. Lopez Jimeno	CRC Press
7	Mine Planning and Equipment Selection	R. Bhattacharya	Oxford University Press
8	Surface Mining Equipment	Martin T. Thompson	Springer

List of Experiments:

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Major Equipment:

- Surface Mine Models
- Hydraulic Excavator Model
- Dumper/Truck Model
- Drill Machine Model
- Blast Design Software



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- vi. Slope Stability Analysis Software
- vii. GPS and GIS Laboratory Setup
- viii. Drone Demonstration Kit
- ix. Total Station
- x. Dust Monitoring Instrument
- xi. Noise Level Meter
- xii. Rock Fragmentation Analysis Software
- xiii. Haul Road Design Model
- xiv. Mine Planning Software (SURPAC / MINEX / Datamine)
- xv. Computer Systems with Mining Software

Open-Source Software/learning website:

1. [NPTEL Mining Engineering Courses](#)
2. [DGMS Official Website](#)
3. [SME Mining Resources](#)
4. [Mine Planning 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	Seminar	15h (need to be changed as per total PBL hours)	Based on the quality of 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 /	Assignment writing. Numerical based	5 assignments of 4 h each	Based on the correctness of submitted assignment



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	Research Writing	assignment is preferable.	Total = 20h	
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
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



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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 5h	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 / Technical Writing / Research Writing	Patent Search and Innovation Gap Identification	10h (Search + Report)	Based on number of 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.)

- Design bench parameters for a surface mine.
- Calculate stripping ratio and production capacity.
- Compare different excavation and loading equipment.
- Analyze environmental impacts of surface mining.
- Study DGMS safety regulations applicable to opencast mines.

b. Micro Projects:

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

- Prepare a mine layout for a small opencast mine.
- Design a haul road system for dumper transportation.
- Develop a slope monitoring plan for highwall safety.
- Prepare a reclamation and mine closure plan for a surface mine.

Note:

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