GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Mining Engineering

Course / Subject Code: DI02022011

Course / Subject Name: Drilling and Blasting Technology

w. e. f. Academic Year:	2024-25
Semester:	2nd
Category of the Course:	ESC-04

Prerequisite:	Before studying Drilling and Blasting in diploma-level mining engineering, students should understand basic mining terminology, interpret sketches, and know the stages of mining to place drilling and blasting in context. Basic knowledge of surface and underground mining methods is essential, along with an understanding of mining administrative bodies to ensure compliance with safety and regulations.
Rationale:	Drilling and blasting are fundamental operations in mining, directly impacting productivity, and safety. For the first-year diploma mining engineering students, this subject provides essential knowledge of drilling techniques, tools, and explosives, preparing them for practical roles in the industry. Understanding blast geometry, safety measures, and statutory requirements ensures responsible operations. The syllabus is structured to provide knowledge necessary for effective and safe drilling and blasting operations in mine.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Identify different types of drilling tools with its applicability.	R, U
02	Enlist types and properties of explosives.	R, U
03	Determine various types of blasting accessories with its safety features.	R, U, A
04	Describe process of blasting in surface mines.	R, U
05	Calculate numerical problems related to blasting geometry.	R, U, A

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	0	3	70	30	0	0	100

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Drilling** 1.1 Introduction, applications of drilling in the mining industry. 1.2 Methods of drilling: percussive drilling, rotary drilling. 1.3 Drilling tools: drilling chisels, augers, drilling bits, fishing tools. 1.4 Borehole lining, borehole flushing, water loss during drilling.	08	18%
2.	**Explosives** 2.1 Definition of explosive, combustion, detonation. 2.2 Common ingredients of explosives. 2.3 Properties of explosives. 2.4 Classification and differentiation: - Low explosive and high explosive - Permitted explosive and non-permitted explosive	09	20%
3.	**Blasting Accessories and Magazine** 3.1 Types of detonators - Plain detonators - Electric detonators --- Instantaneous detonators --- Delay detonators 3.2 Accessories used during blasting: safety fuse, detonating fuse, nonel, circuit tester, crimper, short firing cables, exploders. 3.3 Magazine: criteria of selection of place, safety features. 3.4 Statutory requirements for storage and transportation of explosive.	10	22%
4.	**Blasting Practices in Mines** 4.1 Define Blasting, its purpose and advantages. 4.2 Procedure of blasting in mine: preparation of charging the hole, procedure for firing shots, direct and indirect initiation. 4.3 Stemming: purpose, type of material. 4.4 Solid blasting: precautions, advantages.	09	20%
5.	**Blast Geometry and Secondary Blasting** 5.1 Blast geometry: blast geometry parameters, powder factor, detonator factor. 5.2 Secondary blasting, purpose of secondary blasting, pop shooting, plaster shooting, snake shooting. 5.3 Problems associated with blasting: misfired shot, ground vibration, air blast, fly rock. 5.4 Common causes of accidents due to blasting.	09	20%
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
30	**50**	**20**	**00**	**00**	**00**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:
(a) Books:

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Elements of Mining Technology Vol. 1	D. J. Deshmukh	Publisher: Central Techno Publication ISBN-13: 9788189904333 Published: 2010
2	Surface and Underground Excavations: Methods, Techniques and Equipment	Ratan Raj Tatiya	Publisher: CRC Press ISBN-13: 9780415621199 Published: 2013
3	Drilling and Blasting of Rocks	Francisco Javier Ayala Carcedo	Publisher: Routledge ISBN-13: 9789054101994 Published: 1995
4	Explosive & Blasting Practices in Mines	Dr S.K. Das	Lovely Prakashan, Dhanbad
5	Explosives & Blasting Technique	Dr G. K. Pradhan	Mintech Publications, Bhubaneswar
6	Engineer Rock Blasting Operations	Sushil Bhandari	Publisher: CRC Press ISBN-13: 9789054106586 Published: 1997

(b) Open-source software and website:

1. Powder Factor Calculator: Blast Management International. (2022). Bench Blast Calculator [Excel Spreadsheet]. https://www.blastmanagement.com.au/wp-content/uploads/2022/05/Bench-Blast-Calculator.xlsx.
2. QGIS: QGIS Development Team. (n.d.). QGIS: A Free and Open-Source Geographic Information System [Software]. https://qgis.org/.
3. Explosives: Chapter 8: National Park Service. (n.d.). Explosives: Chapter 8 [PDF]. In Use of Explosives in the National Parks. https://www.nps.gov/parkhistory/online_books/npsg/explosives/Chapter8.pdf.
4. Coal Mines Regulation 2017: Directorate General of Mines Safety. (2017). Coal Mines Regulation 2017 [PDF]. https://www.dgms.net/Coal%20Mines%20Regulation%202017.pdf.

5. Drilling and Blasting Technology (NPTEL Course): National Programme on Technology Enhanced Learning. (n.d.). Explosives Engineering [Online Course]. Indian Institute of Technology (IIT). https://archive.nptel.ac.in/courses/123/105/123105003.
6. Mining and Blasting: Mining and Blasting. (n.d.). Mining and Blasting: A Blog on Mining Techniques and Explosive Engineering [Weblog].https://miningandblasting.wordpress.com.

Suggested Project List:

1. Develop a small-scale model demonstrating the importance of lining the drill hole.
2. Create an interactive flowchart differentiating between permitted and non-permitted explosives.
3. Create an interactive flowchart distinguishing between high and low explosives.
4. Create a model explaining the functions of plain, electric, and delay detonators.
5. Develop a detailed checklist for compliance with safety regulations in explosive storage.
6. Develop an infographic highlighting the precautions and advantages of solid blasting in mines.
7. Design an excel sheet for calculating various blasting geometry parameters.

Suggested Activities for Students:

1. Visit a mine where drilling is performed and observe different drilling methods.
2. Participate in online courses related to drilling and blasting to gain in-depth knowledge of the topic.
3. Give a presentation on topics such as core recovery, borehole surveys, and compositions of explosives to spark students' curiosity.
4. Attend expert lectures on the requirements and methods of controlled blasting to stay updated with the latest industry trends.

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