



# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**

**Subject Code: 3162211**

**Semester – IV**

**Subject Name: Drilling and Blasting Technology**

**Type of course: Professional Core Course**

**Prerequisite: Introduction to Mining (3132201)**

**Rationale:** The course is designed to help the student in understanding the different approaches to reach to the ore body which is below the earth via different entries and development of mines. Knowledge of various exploitation methods of ore/minerals with diverse conditions will definitely help them in the mining fields. This course is helpful to deployment of machineries based on the extraction methods.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE (E)	PA (M)	ESE (V)	PA (I)		
3	0	0	3	70	30	0	0	100

**Content:**

Sr. No.	Content	Total Hours
1.	<b>Rock drilling methods:</b> Introduction; Types of drilling operations used in rock breakage; Applicability and limitations of different drilling methods vis-à-vis rock types and hole diameter. <b>Percussive &amp; Rotary percussive drilling:</b> Introduction; Fundamentals of percussive & rotary percussive drilling; Top hammer drilling; Down the hole hammer drilling; Advance systems; Drilling parameters and their estimation. <b>Rotary drilling:</b> Introduction; Fundamentals of rotary drilling; Drilling parameters and their estimation. Special drilling methods: Introduction; Jet piercing; Water-jet drilling.	8
2.	<b>Exploration Drilling:</b> Boring for exploration; Various types of exploratory drills and their applicability – Auger, Cable-tool, Odex, Core Drills; Core recovery: single and double tube core barrels, wire line core barrel; Storage of cores; Interpretation of borehole data.	9
3.	<b>Explosives and Initiating Systems:</b> Types of explosives, their composition and properties, classification; Selection of explosives; Manufacture, transport, storage and handling of explosives; Testing of explosives; Types of initiating systems – Electrical Detonators, Detonating Fuse, Detonating Relays, NONEL, Electronic Detonators, Blasting accessories, exploders.	9



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4.	<b>Drilling &amp; Blasting in Surface Mines:</b> Drilling: Blasthole drills – types, classification, applicability and limitations; Mechanics of drilling, performance parameters, drilling cost, compressed air requirement for hole cleaning; Selection of drilling systems, drilling errors, organization of drilling. Blasting: Mechanics of rock fragmentation; Livingstone theory of crater formation; Factors affecting blasting, Blast design - estimation of burden and spacing, estimation of charge requirement; Initiation patterns; Secondary blasting – pop and plaster shooting; Problems associated with blasting, Ground vibration and air over pressure, Blast instrumentation.	9
5.	<b>Drilling &amp; Blasting in Underground Mines:</b> Coal mines: Drilling systems and their applicability, blasting-off-solid, different blasting cuts, ring hole blasting, calculation of specific charge, specific drilling and detonator factor, initiation patterns. Metal mines: Drilling systems and their applicability, blast design for horizontal drivages, different blasting cuts, long hole blasting, vertical crater retreat blasting.	9

### Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
50	15	15	10	10	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:

Sr. No.	Author	Title of Books	Publication
1.	Dr. S. K. Das	Explosive and Blasting Practices in Mines	Lovely Prakashan, Dhanbad
2.	G. K. Pradhan	Explosive and Blasting Techniques	Minetech Publication
3.	Carlos Lopez Jimeno	Drilling and Blasting of Rocks	A.A. Balkema, Rotterdam,
4.	Ratan Raj Tatiya	Surface and underground excavations: methods, techniques and equipment	CRC Press / Balkema
5.	Sushil Bhandari	Engineering Rock Blasting Operations	A.A. Balkema, Rotterdam
6.	D. J. Deshmukh	Elements of Mining Technology	Lovely Prakashan, Dhanbad
7.	M. Enamul Hossain	Fundamental and Sustainable Drilling Engineering	Wiley-Scrivener



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8.	B.V. Gokhale	Rotary Drilling and Blasting Large Surface Mines.	CRC Press
9.	Zong-Xian Zhang	Rock Fracture and Blasting. Theory and Applications.	Butterworth-Heinemann
10.	Bibhu Mohanty	Performance Explosive and New Developments	CRC Press
11.	A K Ghose & A. Joshi	Blasting in Mines - New Trends	CRC Press

### Course Outcomes:

Sr. No.	CO statement	Marks % Weightage
CO-1	Ability to select suitable drilling machines under various conditions and drilling required in the mines.	30
CO-2	Ability to select appropriate explosive and its accessories for blasting.	30
CO-3	Ability to understand the mechanisms of rock breakage and blast design	30
CO-4	Ability to understand the safety rules and other parameter associated with Drilling and blasting	10

### Major Equipment:

1. Model of Jack hammer and other drilling machineries, drilling bits, safety tools, etc
2. Model of detonator, delay detonator, exploder and other accessories.
3. Model of open cast blast geometry design.
4. Model of underground various drilling patterns and blasting design.
5. Model of charging the hole for blasting.

### List of Open Source Software/learning website:

1. <https://nptel.ac.in/courses/123/105/123105003/>
2. <http://www.railsystem.net/drill-and-blast-method>
3. <https://www.extractiveshub.org/topic/view/id/41/chapterId/222>
4. <https://mining.komatsu/en-in/surface-mining/blasthole-drills>
5. <https://www.youtube.com/watch?v=YwI9kThccYs>
6. <https://www.youtube.com/watch?v=cI8BBBoCV7gU>
7. <https://www.youtube.com/watch?v=jen5W-CAfL4>
8. <https://www.youtube.com/watch?v=OIhvZcQbvxA>
9. <https://www.rpmdrilling.co.za/blast-hole-drilling-process/>
10. <https://miningandblasting.wordpress.com/about/>