GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3162202
Semester – IV
Subject Name: Underground Metalliferous Mining

Type of course: Professional Core Course

Prerequisite: Introduction to Mining (3132201)

Rationale: The course is designed to helps 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/mineral with diverse condition 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
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Introduction**: Present status of Indian metal mining industry, scope and limitations of it. **Mine Development**: Terminologies and mine entries, mine horizontal and vertical development. Accessories entries.	8
2	**Selection of Stoping method:** Shape and size of the deposit, Thickness of deposit, Dip of the deposit, Physical and mechanical characteristics of the ore and the enclosing rocks, Presence of geological disturbances, Degree of mechanization and output required, Ore grade and its distribution, and value of the product, Depth of the deposit, Desirable features of selecting a stoping method, Classification – stoping methods	12
3	**Open stoping method and Unsupported method:** Room and Pillar method, Sublevel stoping method, large diameter blast hole method, Shrinkage stoping method its introduction, applicability, stope preparation, unit operation, stopping operations, merit, demerits, limitations and transportation.	12
4	**Supported stoping methods:** Cut and fill stoping and square set stopping method; its introduction, applicability, stope preparation, unit operation, stopping operations, merit, demerits, limitations and transportation.	08

5	**Caving Method:** Sublevel and block caving methods; its introduction, applicability, stope preparation, unit operation, stopping operations, merit, demerits, limitations and transportation.	**08**
6	**Mine Closure:** Introduction, phase and planning guideline of mine closure.	**06**

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**	**5**	**5**

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.	Howard L. Hartman	Introductory to Mining Engineering	John Wiley and Sons
2.	W. A. Hustrulid, William A. Hustrulid,	Underground Mining Methods: Engineering fundamentals and international case studies	Society for Mining, Metallurgy, and Exploration (SME)
3.	Darling, Peter	SME Mining Engineering Handbook Volume I and II	Society for Mining, Metallurgy, and Exploration (SME)
4.	Ratan Raj Tatiya	Surface and underground excavations: methods, techniques and equipment	CRC Press / Balkema
5.	Y. P. Chacharkar	A study of Metalliferous Mining Methods	Lovely Prakashan, Dhanbad
6.	D. J. Deshmukh	Elements of Mining Technology	Lovely Prakashan, Dhanbad

Course Outcomes:

Sr. No.	**CO statement**	**Marks % Weightage**
CO-1	Ability to construct the mine developments to the metal deposit	20
CO-2	Ability to extract the ore block by supported un-supported methods.	40
CO-3	Ability to extract the ore block by modern methods.	20
CO-4	Ability to identify the machineries used, methods of extraction and mine closure of underground metal mine.	20

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List of Experiments:

Sr. No.	Experiments
1.	Various terms, factors influencing selection of method of work and classification of underground methods.
2.	Observe and record Raise drivage methods, (a) Alimak Raise Climber (b) Drop Raising
3.	Observe and record shrinkage stoping method.
4.	Observe and record sub level stoping method.
5.	Observe and record cut and fill stopimg method.
6.	Observe and record square – set stoping method.
7.	Observe and record sub level caving method.
8.	Observe and record block caving method.

Major Equipment:

1. Model of shaft and other mine entries.
2. Model of underground metal mining
3. Model of underground transportation system
4. Laboratory model of crusher, grizzly and secondary breaking system
5. Various model of metal mining methods.
6. Model of ore handling and processing

List of Open Source Software/learning website:

1. https://newpacificmetals.com/mining-101/underground-mining-methods
2. https://www.maxam.net/en/fundacion/catedra_maxam/blasting_solutions/underground_metal_mining
3. http://dggs.alaska.gov/webpubs/usbm/b/text/b419.pdf
4. https://miningandblasting.files.wordpress.com/2009/09/mining_methods_underground_mining.pdf
5. https://www.google.com/search?q=UNDERGROUND+METAL+MINING&sxsrf=ALeKk00IfrH0brtQzjGZT_hG575SY2PhCg:1599418446510&ei=TjBVX_foHr3Zz7sP2uC2iAI&start=10&sa=N&ved=2ahUKEwj3x-eCmtXrAhW97HMBHVqwDSEQ8tMDegQIDhAu&biw=1366&bih=657
6. http://www.huttigold.co.in/
7. https://www.hindustancopper.com/Page/KCCPlant
8. http://www.ucil.gov.in/
9. https://www.nmdc.co.in/
10. https://www.hzlindia.com/