

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

**COURSE CURRICULUM
COURSE TITLE: UNDER GROUND METALLIFEROUS MINING
(COURSE CODE: 3362204)**

Diploma Programme in which this course is offered	Semester in which offered
Mining Engineering	Sixth

1. RATIONALE

The course is designed to help the student in understanding the different approaches to reach to the ore body mass below surface, underground metalliferous mine development and comprehend various methods of working for exploitation of ore body. This course is helpful in grasping process of exploration of mineral body and also to gain knowledge about the various safety procedures to be maintained during underground mining.

2. COMPETENCY

The course content should be taught and curriculum should be implemented with the aim to develop required skills in the students so that they are able to acquire leading to the achievement of the following competencies -

- **Manage Under Ground Metalliferous mining scientifically.**

3. COURSE OUTCOMES (CO's)

The theory should be taught and practical should be carried out in such a manner that students are able to acquire required learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- Select and design suitable mode of entry to underground deposits based on site conditions.
- Select suitable mining methods and machineries for mine development.
- Explain various stoping methods used in underground mines
- Follow the safe working procedure for mining activities.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			C	ESE	PA	ESE	PA	150
4	0	2	6	70	30	20	30	

Legends: L-Lecture; T – Tutorial/Teacher Guided Student Activity; P -Practical; C – Credit; ESE -End Semester Examination; PA - Progressive Assessment.

5. COURSE CONTENT DETAILS

Unit	Major Learning Outcomes (In the Cognitive Domain)	Topics and Sub-topics
Unit – I Introduction to Metalliferous Mine Working	1a. Explain scope and drawbacks of underground mining. 1b. Explain the different mode of entries with applicability condition.	1.1 Scope and limitations of underground mining. 1.2 Choice of mode of entries of underground deposits- Adit, Shaft, Incline, Decline, combined modes and their applicability conditions 1.3 Choice of level interval / back length, ore bins and waste bins
Unit – II Mine Development Methods	2a. Explain various mine development methods with applicability conditions.	2.1 Driving of raises and winzes: Open raising method, Compartment method of raising, Alimak raise climber in cycle of operation, Drop raising, Raise borers, Winzes 2.2 Drivage of companion level, cross-cut, drift their size and shape 2.3 Drilling pattern – Burn Cut, Wedge Cut, Cycle of Operation 2.4 Use of Machineries like Single and Double boom drill jumbo, Jack hammer, Stoper machine, LPDT (Low Profile Dump Truck)
Unit– III Methods of Working	3a. Explain selection and classification of various stoping methods.	3.1 Selection and Classification of stoping methods: Underhand, Overhand, Breast stoping, Shrinkage stoping, Square set stoping and Sub-level stoping methods 3.2 Cut and fill stoping methods 3.3 Block caving method 3.4 Vertical crater method

6. SUGGESTED SPECIFICATION TABLE WITH HOURS and MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks (Duration – 56 Hours)			
			R Level	U Level	A Level	Total
1.	Introduction to Metalliferous Mine Working	14	06	06	04	16
2.	Mine Development Methods	20	08	08	10	26
3.	Method of Working	22	08	08	12	28
Total		56	22	22	26	70

Legends: R = Remember, U = Understand, A= Apply and above Level (Bloom's revised 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.

7. SUGGESTED PRACTICAL / EXERCISES

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (**outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

*Note: Here only outcomes mainly in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Practical /Exercise (Outcomes in the Psychomotor Domain)	Approx. Hours Required
1	I	Observe and record development of Metalliferous ore deposits.	4
2	II	Observe and record Raise drivage methods. (a) Alimak Raise Climber (b) Drop Raising	2 2
3	II	Draw simple leveled sketches of following machines and mention their specifications (sizes and operations they can perform) on the drawing sheet. (Explore internet/websites of suppliers of such machines) (i) Single and Double boom drill jumbo, (ii) Jack hammer, (iii) Stoper machine, (iv) LPDT	8
3	III	Observe and record various Stoping Methods. (a) Brest Stoping method. (b) Under Hand andover Hand Stoping method. (c) Sub-level Stoping Method. (d) Shrinkage Stoping Method. (e) Block Caving Method. (f) Square Set Stoping Method.	2 2 2 2 2 2
Total Hours			28

8. SUGGESTED STUDENT ACTIVITIES

- i. Visit to underground Metalliferous mine.
- ii. Prepare model of stoping method.
- iii. Explore internet for study of underground mine working and prepare a report.
- iv. Explore internet for study of cycle of operation of each activity of mine working and prepare notes on each.

9. SPECIAL INSTRUCTIONAL STRATEGIES (If any)

- i. Ask students to prepare charts or/and models related to different underground mining activities.
- ii. Arrange field visits and discuss case studies of mining layouts and methods used in different underground mines in India and abroad.
- iii. Arrange seminar on different issues related to underground mining (ask students to prepare ppts in group of four to five on different topics by exploring internet/library)
- iv. Arrange expert lectures.

10. SUGGESTED LEARNING RESOURCES**A) Books**

S. No.	Author	Title of Books	Publication
1	Deshmukh, D.J.	Elements of mining	Denett and Co, Nagpur
2	Chacharkar, Y.P.	Metalliferous mining methods	Lovely Prakashan, Dhanbad
3	Hartman, Howard L.	Introductory to Mining Engineering	John Wiley and Sons Publication, New Delhi
4	UMS Series	Blue Volume/ Red Volume	Lovely Prakashan, Dhanbad
5	Mishra, G.B.	Surface Mining	Lovely Prakashan, Dhanbad

B) Major Equipment/Instrument with Broad Specifications

- i. Various mining models.
- ii. Various charts for ventilation system, transportation system, safety slogan.

C) Software/Learning Websites

- i. <http://firwin.blogspot.in/2012/02/underground-versus-open-pit-mining.html>
- ii. [http://en.wikipedia.org/wiki/Underground_mining_\(hard_rock\)](http://en.wikipedia.org/wiki/Underground_mining_(hard_rock))
- iii. <http://en.wikipedia.org/wiki/Stoping>
- iv. [http://en.wikipedia.org/wiki/Raise_\(mining\)](http://en.wikipedia.org/wiki/Raise_(mining))
- v. <http://miningandblasting.wordpress.com/tag/burn-cut/>
- vi. <http://www.mining.sandvik.com/> (For Drill Jumbo and LPDT)
- vii. <http://www.mindrill.com/jackleg-stopper-drills.html>
- viii. <http://en.wikipedia.org/wiki/Jackhammer>
- ix. <http://www.youtube.com/watch?v=BvhIvi96q0Q> (Cut and Fill Stoping)

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics**

- **Prof. S. G .Srivastav**, H.O.D, Mining Engg. Dept., Govt. Polytechnic, Bhuj
- **Prof. C. V. Thakor**, Lecturer, Mining Engg. Dept., Govt. Polytechnic, Bhuj
- **Prof. S. C. Dabhekar**, Lecturer, Mining Engg. Dept., Govt. Polytechnic, Bhuj
- **Prof. S. S. Shah**, Lecturer, Mining Engg. Dept., Govt. Polytechnic, Bhuj

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- **Dr. C. K. Chugh**, Professor, Department of Mechanical Engineering
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