

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

**COURSE CURRICULUM
COURSE TITLE: UNDERGROUND MINING OF COAL
(COURSE CODE: 3362203)**

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 coal mining methods, their applicability conditions, merits and demerits, various stowing methods, ventilation and transportation system. This course is helpful to select suitable and economical method of coal mining and also to gain knowledge about the management of various difficulties which arise during the workings of coal mine.

2. COMPETENCY

The course content should be taught and curriculum should be implemented with the aim to develop required skills leading to the achievement of the following competency.

- **Plan and supervise scientific underground mining methods based on site conditions for safe extraction of coal.**

3. COURSE OUTCOMES

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.

- Explain characteristics of coal seams in India.
- Explain board and pillar working in underground mine with proper ventilation.
- Explain safe and economical coal pillar extraction method.
- Describe the safe working procedure for mining activities.
- Explain Longwall working in underground mine
- Describe safe stowing practices.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
L	T	P		Theory Marks		Practical Marks		Total Marks
				ESE	PA	ESE	PA	
4	0	4	8	70	30	40	60	200

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

5. COURSE DETAILS

Unit	Major Learning Outcomes (In the Cognitive Domain)	Topics and Sub-topics
Unit – I Characteristics of Coal and Mining conditions in Indian coal Fields	1a. Describe characteristics of coal seams in India. 1b. Explain various methods for underground Coal mining.	1.1 Characteristics of Indian Coal seams. 1.2 Mining conditions in Indian coal fields –Jharkhand, Bihar, Orissa, Madhya Pradesh, Maharashtra, and Andhra Pradesh. 1.3 Classification of Underground Coal Mining method: i. Board and pillar Mining ii. Longwall advancing and retreating. iii. Horizon Mining. iv. Hydraulic Mining
Unit – II Board and Pillar Method – Development	2a. Explain board and pillar Method. 2b. Describe the different drivage method used in B and P method. 2c. Explain Panel System of board and pillar method. 2d. Explain standards of Ventilation.	2.1. Elements of board and pillar mining:- gallery, headings, face, drift, cross cut, pillar, dip and strike, apparent dip, junction, panel, district, barrier, roof and floor 2.2. Applicability conditions of B and P method with advantage and disadvantage 2.3. Methods of driving galleries:Manual with use of explosive (Solid Blasting) - Hand held coal drill machine and Universal drilling machine 2.4. Mechanical without use of explosives - Continuous miner, Road header, Size of pillar, Shape of pillar – Square, Rectangular, Rhombus 2.5. Panel designing– finding out number of Pillar in a panel for a particular seam, various panel designing operation depending upon seam conditions, barrier formation, Advantages 2.6. Ventilation of mine working with standard of ventilation
Unit– III Board and Pillar Mining– Depillaring /Final Extraction of Coal	3a. Describe the Preparatory arrangements taken before depillaring. 3b. Explain different line of Extraction. 3c. Explain about various problems that arise during depillaring. 3d. Explain Transportation system in B and P	3.1 Preparatory arrangement before Depillaring 3.2 Line of extraction – Straight line, Diagonal line, Step diagonal, Steep diagonal line 3.3 Depillaring by Caving – Applicability conditions, Difficulties – Local fall, Main fall, Air blast, Overriding of pillar, Inundation and their preventive measures.

Unit	Major Learning Outcomes (In the Cognitive Domain)	Topics and Sub-topics
	method.	3.4 Depillaring by Stowing – Applicability conditions, material used for stowing, problems associated with preventive measures. 3.5 Transportation System: For Men – Staircase, Cage, Man riding System. 3.6 Coal and Material Transport – Skip, Rope haulage system, Belt conveyor
Unit-IV Longwall Method	4a. Describe the longwall method 4b. Explain panel preparation in longwall method. 4c. Describe various methods of extraction used in longwall mining. 4d. Explain ventilation for longwall faces. 4e. Explain coal and material transport in longwall system. 4f. Explain different types of face support in longwall method.	4.1 Types of Longwall Methods: Advancing longwall-merits and demerits, Retreating longwall-merits and demerits 4.2 Length and direction of face 4.3 Panel preparation – various road ways driven for ventilation and transport purpose. Face length calculation, overall size of panel. 4.4 Longwall extractions – Cyclic and Non-cyclic system, Single Unit and Double Unit face 4.5 Face cutting and Sumping operation by shearer and plough. 4.6 Ventilation of long wall faces. 4.7 Coal and Material Transport system 4.8 Types of Face support in longwall method – Powered supports, Prop support.
Unit- V Stowing Practice	5a. Describe various types of stowing methods. 5b. Explain sand transportation system. 5c. Explain surface arrangements of sand stowing plant. 5d. Explain sand stowing Operation. 5e. Describe various problems arise during sand stowing.	5.1 Different types of stowing – Hydraulic, pneumatic and mechanical. 5.2 Sand Transportation: Sand gathering/ mining operation of river bed end. Methods - manual, shovel, pumping of sand slurry. 5.3 Transportation of sand to mines Manual and shovel loading of trucks/dumpers, Pipe haulages, Railways, Aerial ropeways, Belt conveyors. 5.4 Surface sand bunkers 5.5 Surface sand stowing arrangements - Mixing chambers, various devices for efficient hydraulic conveyance of sand – water meter, lea recorder. 5.6 Stowing operation - Layout of stowing pipes in shafts and roadways up to stowing faces. Relation between Hydraulic Gradient Line and Hydraulic

Unit	Major Learning Outcomes (In the Cognitive Domain)	Topics and Sub-topics
		Profile Line and H: L ratio. 5.7 Problems during Sand Stowing: Pipe jamming, pipe wears, Maintenance of pipes and fittings.

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

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1	Characteristics of Coal and Mining Conditions in Indian Coal Fields	06	4	2	2	8
2	Board and Pillar Method – Development	16	4	8	10	22
3	Board and Pillar Mining–Depillaring /Final Extraction Coal	12	3	4	7	14
4	Longwall Method	12	3	4	7	14
5	Stowing Practice	10	3	3	6	12
	Total	56	17	21	32	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
1	1	Plan Layout of a Horizon Mining for given filed conditions.	4
2	1	Plan hydraulic Mining for given filed conditions for given filed	4

S. No.	Unit No.	Practical /Exercise (Outcomes in the Psychomotor Domain)	Approx. Hours
		conditions.	
3	2	Plan board and pillar Method of working for given filed conditions.(Two exercises)	8
4	2	Determine size of panel in board and pillar method for given filed conditions. (Two exercises)	8
5	4	Determine Percentage extraction of coal in a development area for given filed conditions.(Two exercises)	8
6	4	Undertake Longwall Method of working for given filed conditions .(Two exercises)	8
7	4	Determine size of panel in longwall method of mining for given filed conditions. (Two exercises)	8
8	5	Determine H.F.L. and gradient line for stowing practice in u/g mines for given filed conditions.	4
9	5	Study and record Stowing Organization system used in mines.	4
Total Hours			56

8. SUGGESTED STUDENT ACTIVITIES

- Visit to underground coal mine.
- Prepare model of B and P method.
- Explore internet for study of underground coal mine working and prepare a report.
- Explore internet for study of cycle of operation of each activity of mine working and prepare notes on each.
- Visit websites of different coal fields of India and a prepare a comparative report on type of coal, size of deposits, mining methods used etc.

9. SPECIAL INSTRUCTIONAL STRATEGIES (If any)

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

10. SUGGESTED LEARNING RESOURCES

A) Books

S. No.	Author	Title of Books	Publication
1	Deshmukh D.J.	Elements of mining – Vol.1	Lovely Prakashan, Dhanbad
2	Singh. R.D.	Principles and Practices of Modern Coal Mining	Lovely Prakashan, Dhanbad
3	Das Samir kumar	Advance coal Mining Tech.	Lovely Prakashan, Dhanbad
4	Ghatak S.	Winning and Working Coal	Lovely Prakashan, Dhanbad

S. No.	Author	Title of Books	Publication
5	Prasad, N. and . Jha Gautam Kr	An Experienced of Long Wall Mining in India	Lovely Prakashan, Dhanbad

B) Major Equipment/Instrument with Broad Specifications

- i. Mining Models
- ii. Various charts of ventilation, transportation system and stowing operation.
- iii. Underground Transportation system models

C) Software/Learning Websites

- i. [http://en.wikipedia.org/wiki/Underground_mining_\(soft_rock\)](http://en.wikipedia.org/wiki/Underground_mining_(soft_rock))
- ii. <http://scienceandtech.cmpdi.co.in/PDF%20Files/Mining%20Methods.pdf>
- iii. http://en.wikipedia.org/wiki/Longwall_mining
- iv. <http://www.slideshare.net/sankarsulimella/pillar-design-in-coal-mines>
- v. http://www.undergroundcoal.com.au/fundamentals/06_overview.aspx (Pillar Extraction)
- vi. www.novamining.com

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
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Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. C. K. Chugh**, Professor, Department of Mechanical Engineering
- **Dr. P. Verma**, Professor, Department of Vocational and Entrepreneurship Education