

**CURRICULUM OF 3<sup>RD</sup> SEMESTER  
FOR  
DIPLOMA IN MINING ENGINEERING  
(EFFECTIVE FROM SESSIONS 2020-21)**



**WEST BENGAL STATE COUNCIL OF TECHNICAL & VOCATIONAL  
EDUCATION AND SKILL DEVELOPMENT**

**(A Statutory Body under West Bengal Act XXVI of 2013)  
(Technical Education Division)**

**Karigari Bhavan, 4th Floor, Plot No. B/7, Action Area-III, Newtown, Rajarhat, Kolkata-700 160**

## Curriculum for Diploma in Mining Engineering

### SEMESTER III

Sl. No	Category	Code No.	Course Title	Hours per week			Total contact hrs/ week	Credits	Marks
				L	T	P			
1.	Program core course	MINPC 301	Introduction to Mining Technology	3	0	0	3	3	100
2.	Program core course	MINPC 302	Underground Mine Environment	2	0	0	2	2	100
3.	Program core course	MINPC 303	Drilling & Blasting	2	0	0	2	2	100
4.	Program core course	MINPC 304	Underground Coal Mining	2	0	0	2	2	100
5.	Program core course	MINPC 305	Surface Mining	3	0	0	3	3	100
6.	Program core course	MINPC 306	Mining Geology	2	0	0	2	2	100
7.	Program core course	MINPC 311	Underground Mine Environment Lab.	0	0	2	2	1	100
8.	Program core course	MINPC 312	Drilling & Blasting Lab.	0	0	2	2	1	100
9.	Program core course	MINPC 313	Mining Operations Lab.	0	0	2	2	1	100
10.	Program core course	MINPC 314	Mining Geology Lab.	0	0	2	2	1	100
11.	Internship-I after Semester II	MINSI 341		0	0	0	0	1	100
<b>TOTAL</b>							<b>22</b>	<b>19</b>	<b>1100</b>

L- LECTURE, T- TUTORIAL, P- PRACTICAL/ LAB

Course Code	:	MINPC 301
Course Title	:	Introduction to Mining Technology
Number of Credits	:	3 (L : 3, T : 0, P : 0)
Prerequisites	:	Basic knowledge in Mathematics, Physics, Chemistry & Engineering Graphics
Course Category	:	PC

#### TOPIC WISE DISTRIBUTION OF THE COURSE:

UNIT	TOPIC	LECTURE PERIODS	TUTORIAL PERIODS
I	<b>Introductory concepts</b>	9	0
II	<b>Indian Mining &amp; Mineral industries</b>	6	0
III	<b>Mode of entry to Coal/ Mineral deposit</b>	3	0
IV	<b>Exploratory Drilling</b>	9	0
V	<b>Shaft Sinking</b>	12	0
VI	<b>Coal as a Fuel</b>	6	0

#### Course Objectives:

Following are the objectives of this course:

- To have an introductory idea about occurrence of coal & minerals and their mining.
- To have an introductory idea about the Indian Mining Industry.
- To understand the different modes of entry to Coal/ Mineral deposits.
- To know about pre-mining exploratory operations.
- To know the development of a new mine.
- To know Coal as a fuel.

#### Course Content:

##### Unit- I Introductory concepts

- Basic concepts- Rock, Mineral, Mineral deposit, Mine, Coal seam etc.
- Origin & formation of Coal
- Brief idea about the different processes of formation & mode of occurrence of mineral deposits.

- Petrology-Classification rocks- Igneous, Sedimentary & Metamorphic; Different forms & structures of igneous rocks- Dyke, Sill, Laccolith, Phacolith, Batholith, Pillow Structure; Different forms & structures of sedimentary rocks- bedding, cross-bedding, graded bedding, ripple marks, mud cracks; Metamorphism
- Structural geology-
  - Primary structure- Utility of studying primary structures as above.
  - Secondary structure- definitions of dip, strike, fold, fault, joint & unconformity; Types of Fold & Fault; Criteria for their recognition

## **Unit- II Indian Mining & Mineral industries**

- Indian Mining & Mineral industries- Introduction; Classification of mineral materials
- Indian occurrences of coal
- Indian occurrences & ore minerals of the following mineral deposits; Iron, Manganese, Gold, Copper, Aluminium, Chromium, Lead-Zinc, Petroleum & Natural Gas

## **Unit- III Mode of entry to Coal/ Mineral deposit**

- Haul roads & Steps- Basic concepts
- Incline & Adit- Applicability, Size & Shape, Site selection
- Shaft- Applicability, Size, Shape & Number
- Shaft vs Incline; Relevant Regulations, i.e. Regulation 71- 75 of CMR 2017
- Other modes of entry- Basic concept only

## **Unit- IV Exploratory Drilling**

- Prospecting- Definition, different methods in brief only.
- Boreholes- Uses, Classification of boring/ drilling
- Percussive methods- by rigid rods, Power drilling, Rope drilling, Boring tools used
- Rotary drilling- Various methods of operation, Different types of bits, Diamond drilling
- Feed mechanism- Screw feed & Hydraulic feed
- Exploration & Drilling - Basic idea of Exploration & Prospecting; Exploratory agencies in India
- Core recovery- Single tube, Double tube & Triple tube core barrel- Description & Operation; Wireline core barrel
- Troubles during boring operation- Caving of borehole, Loss of water, Deviation of borehole, Cutter bit or rod damage/ disengagement, breakage & loss of diamond- causes & remedies; Borehole survey & findings; Fishing tools

## **Unit- V Shaft Sinking**

- Types of shafts- Vertical & Inclined shafts; Site selection for a shaft, Shaft Pillar, Rules for size of a Shaft Pillar
- Conventional method of shaft sinking- Drilling, Blasting, Mucking & Hoisting; Surface plant & equipment
- Wall support & shaft lining- Temporary & Permanent
- Auxiliary operations- dewatering, ventilation, lighting, shaft centering etc.
- Shaft sinking through difficult strata- Caisson method, Cementation method, Freezing process- Description & Operation etc.

- Deepening of existing shaft; Widening of shaft; Upward drivage of shaft
- Mechanised shaft sinking- Vertical Shaft sinking machine, Shaft Boring system- Merits & Demerits, Description & Operation

**Unit- VI Coal as a Fuel**

- Different types of fuel; Coal as a fuel
- Ranks of coal; Grades of coal; Banded constituent of coal; Commercial grades of coal
- Proximate & Ultimate analysis of coal
- Calorific value & its determination
- Carbonisation of coal- Low & High temperature carbonisation
- Coking coal and its properties like Caking index, Shatter index, Micum index etc.; Consumption of coking coal in India; Different types of coke
- Coke oven gas, Producer gas, Water gas etc.
- Consumptions of coal in different industries

**Suggested learning resources:**

1. Elements of Mining Technology, Vol 1, D.J. Deshmukh, Denet Publications, Nagpur
2. Introduction to Mining, G.K.Pradhan, Mintech Publications, Bhubaneswar
3. Principle & Practices of Coal Mining, R.D. Singh
4. Hartman, H. L., Introduction to Mining Engineering, John Wiley and Sons, Second Edition, 1999.

**Course outcomes:**

After completing this course, student will be able to:

- Explain the fundamental geological aspects of coal and mineral deposits.
- Describe the mining industry as a whole, particularly the Indian Mining sector.
- Describe the modes of access to a deposit.
- Design the exploratory drilling techniques.
- Explain the process of shaft sinking.
- State the various properties of coal as a fuel.

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Course Code	:	MINPC 302
Course Title	:	Underground Mine Environment
Number of Credits	:	2 (L: 2, T: 0, P: 0)
Prerequisites	:	Basic knowledge in Mathematics, Physics, Chemistry & Engineering Graphics
Course Category	:	PC

## TOPIC WISE DISTRIBUTION OF THE COURSE:

UNIT	TOPIC	LECTURE PERIODS	TUTORIAL PERIODS
I	<b>Atmospheric Air and Mine Air</b>	6	0
II	<b>Damp</b>	2	0
III	<b>Firedamp</b>	6	0
IV	<b>Detection of Mine Gases</b>	6	0
V	<b>Heat and Humidity</b>	6	0
VI	<b>Mine Dust</b>	4	0

### Course Objectives:

The followings are the objective of this course -

- To be aware about different mine gases and dangers associated with these gases above the permissible limit.
- To learn about different compositions of gases which are potentially dangerous.
- To learn about inflammable gas in mine and preventive measures to be taken.
- To perform different tests to detect different mine gases.
- To identify the causes of heat and humidity addition in the mine atmosphere and to perform different tests to measure the same.
- To know about the hazard associated with respirable mine dust and control measures of the same.

### Course Content:

#### UNIT-I Atmospheric Air and Mine Air

- Composition of atmospheric air and mine air
- Mine gases and their properties, sources, physiological effects, permissible concentration/ limit in percentage and PPM (Parts Per Million).
- Standards of ventilation in mine.

#### UNIT-II Damp

- Blackdamp – Calculation of percentage of blackdamp from an analysis of a sample of mine air.
- Firedamp – Composition and threat
- Whitedamp, Composition and threat
- Stink Damp - Composition and threat
- Afterdamp - Composition and threat

### **UNIT -III Firedamp**

- Emission of firedamp in U/G working- Factors, Gradual Exudation, Outburst - Prediction of outburst, Prevention of outburst, Gas Blowers - Dealing with Gas Blowers.
- Calculation of methane emission per tonne of coal mined.
- Statutory precautions against inflammable gas (under CMR-2017- Regulation: 166)
- Gassy seam of the First, Second and Third degree
- Streaming and layering of methane
- Methane Drainage

### **UNIT- IV Detection of Mine Gases**

- Flame Safety Lamp- Working principle, Description of various parts of FSL, Gas testing by FSL, Accumulation test & Percentage test, Precautions during gas testing, Limitations of FSL.
- Methanometer – working principle, detection procedure
- Carbon monoxide detector- detection procedure
- Brief idea on Multi Gas Detector

### **UNIT- V Heat and Humidity**

- Source of heat in mines, Geothermal gradient
- Dry bulb temperature, Wet bulb temperature, Humidity, Relative humidity, Measurement of Relative humidity - Hygrometer, Whirling Hygrometer.
- Kata Thermometer - Instrument description, working principle, Determination of cooling power using kata thermometer
- Effect of heat and humidity on human body
- Control measures against Heat and Humidity in underground mines.

### **UNIT- VI Mine Dust**

- Airborne respirable dust- Sources and Control measures, Physiological effects
- Permissible limit of airborne respirable dust as per statute.
- Airborne respirable dust survey with personal dust sampler.

### **Suggested learning resources:**

1. D.J. Deshmukh: Elements of Mining Technology Vol. 2
2. G. B. Misra: Mine Environment and Ventilation, OXFORD UNIVERSITY PRESS
3. C.M.R. 2017 & DGMS Circulars
4. S.P. Banerjee : Mine Ventilation

### **Course Outcomes:**

After completion of this course, students will be able to-

- Take precautions against different asphyxiating, toxic and noxious gases in mines.
- Deal with potentially dangerous damp.
- Take necessary precautions against accumulation of inflammable gas in underground mines.
- Execute the detection of different mine gases and measure the concentration of the same.
- Keep the mine working environment free from high heat and humidity.

- Apply his acquired knowledge to maintain the airborne respirable dust below the permissible limit in the working environment.

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Course Code	:	MINPC 303
Course Title	:	Drilling & Blasting
Number of Credits	:	2 (L: 2, T: 0, P: 0)
Prerequisites	:	Basic knowledge in Mathematics, Physics, Chemistry & Engineering Graphics
Course Category	:	PC

**TOPIC WISE DISTRIBUTION OF THE COURSE:**

UNIT	TOPIC	LECTURE PERIODS	TUTORIAL PERIODS
I	<b>Production Drilling in Mines</b>	6	0
II	<b>Explosives</b>	6	0
III	<b>Blasting Practices in U/G Mines</b>	8	0
IV	<b>Drilling Practices in O/C Mines</b>	4	0
V	<b>Blasting Practices in O/C Mines</b>	6	0

**Course Objectives:**

Following are the objectives of this course:

- To understand operational aspects of different types of drilling machines.
- To have an idea about explosives & accessories used in U/G & O/C mines
- To know about different kinds of explosives used in mines.
- To learn blasting practices in underground mines.
- To learn drilling practices in opencast mines.
- To learn blasting practices in opencast mines.

**Course Content:**

**Unit- I Production Drilling in Mines**

- Production drill machines- factors of selection, different types including pneumatic drilling- operational aspects



- Types of flushing fluid and circulation of flushing fluid- Direct circulation & Reverse circulation
- Different drilling patterns used in UG mines
- Drill bits- different types; their field of applications
- Different types of drill rods & their applications
- Pollution control measures in drilling.- basic concepts only

## **Unit- II Explosives**

- Definition of explosives, Constituents of explosives, Properties of explosives, Classification of explosives (Low & High explosives, Permitted & Non-permitted explosives) and their examples & uses
- Detonators & Accessories- Construction of a detonator; Different types of detonators; Advantages and Disadvantages of delay detonators; Relays, Safety Fuses, Detonating Fuses (Cord); Explosive Booster
- Exploders-Different types, construction and safety feature of exploders
- Explosives used in opencast mines including ANFO, HANFO, Slurry Explosives (SMS & PMS), LOX, Emulsion Explosives Including SME

## **Unit- III Blasting Practices in U/G Mines**

- Shot firing tools, preparation of charge & procedure of firing shots- direct and indirect initiation, simultaneous and delay firing
- Calculation of explosive quantity, powder factor, detonator factor etc.
- Solid blasting- Advantage and disadvantage, precautions and restrictions, patterns of shot holes
- Transportation & storage of explosive, Handling of explosives
- Magazine- Types, Layout, Construction & Safety features
- Common causes of accidents from explosives; Misfired shots, Dealing with misfires; Blown through & blown out shots and associated dangers, Remedial measures required.

## **Unit- IV Drilling Practices in O/C Mines**

- Vertical holes, Inclined holes, Advantages & disadvantages of Inclined holes, Subgrade Drilling, Stiffness ratio
- Different drilling patterns used in O/C mines
- Blast Design Parameters- Bench height, Blast hole diameter, Burden, Spacing, Hole depth, Subgrade, Stemming, Hole Inclination, Blast Size (Length & Width).

## **Unit- V Blasting Practices in O/C Mines**

- Blasting accessories, charging of blast holes, Procedure of blasting, Danger Zone, Blasting shelter
- Deck Charging, Muffle Blasting, Single row & multi row blasting using relays, Blasting with non-electric detonator (NONEL) and shock tube-based system; Blasting with electronic detonators (brief idea only).
- Controlled blasting techniques; Precautions necessary for blasting in hot holes; Safety measures during the approach and progress of an electric storm; Sleeping Holes.
- Secondary Blasting-Pop Shooting, Plaster shooting- procedures, advantages and disadvantages; Cast Blasting- elementary idea only.

**Suggested learning resources:**

1. Elements of Mining Technology, Vol 1, D.J. Deshmukh, Denet Publications, Nagpur
2. Explosive and Blasting Practices in Mines, Samir Kumar Das, Lovely Prakashan, Dhanbad
3. Principle & Practices of Coal Mining, R.D. Singh
4. C.M.R. 2017
5. Surface Blast Design. Konya K. J. and Walter E. J. Prentice Hall. 303 p.
6. Fundamentals of Drilling Engineering. Society of Petroleum Engineers. Mitchell R. F. and Miska S.
7. Pradhan G. K. and Sandhu M. S. 2002. *Blasting Safety Manual*. IME Publications,

**Course outcomes:**

After completing this course, student will be able to:

- Select and know the use of a drill machine for given conditions.
- Select suitable drill patterns for various rock conditions.
- Use different types of explosives in mines.
- Perform blasting operations in U/G mines.
- Explain drilling operations in O/C mines.
- Perform blasting operations in O/C mines.

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Course Code	:	MINPC 304
Course Title	:	Underground Coal Mining
Number of Credits	:	2 (L : 2, T : 0, P : 0)
Prerequisites	:	Basic knowledge in Mathematics, Physics, Chemistry & Engineering Graphics
Course Category	:	PC

**TOPIC WISE DISTRIBUTION OF THE COURSE:**

UNIT	TOPIC	LECTURE PERIODS	TUTORIAL PERIODS
I	<b>Selection of methods of working</b>	4	0
II	<b>Bord and Pillar Mining- Development</b>	8	0
III	<b>Bord and Pillar Mining- Depillaring</b>	4	0
IV	<b>Longwall Mining</b>	8	0
V	<b>Stowing</b>	6	0

## **Course Objectives:**

Following are the objectives of this course:

- To know the factors for different methods of working of a coal mine.
- To learn the development and depillaring operations of Bord and Pillar working.
- To learn the development and extraction processes associated with Longwall working.
- To know the operations of various machineries used in an underground coal mine.
- To understand the stowing operation in mining.

## **Course Content:**

### **Unit- I Selection of methods of working**

- Factors influencing the selection of mining methods- Physical, Technical & Economical
- Classification of coal mining methods in India.

### **Unit- II Bord and Pillar Mining- Development**

- Suitability or Unsuitability of Bord and Pillar method
- Idea of Galleries and Pillars; Basic terminologies associated with Bord and Pillar method of working
- Development by Cross cut
- Classification of Bord and Pillar- Schematic layouts, advantages & disadvantages of different methods giving special emphasis on Panel system of working
- Main elements of Bord and Pillar – size of pillars, size of panels, size of coal barriers, requirements in Panel
- Working principles of Development in Bord and Pillar method of working, Activities associated with solid blasting- basic idea only, calculation of percentage of extraction
- Machineries associated in Bord and Pillar working – Drill, SDL, LHD, Haulage, Conveyor – operational aspects only
- Simple layout of Development in Bord and Pillar

### **Unit- III Bord and Pillar Mining- Depillaring**

- Depillaring – Factors influencing depillaring, Preparatory arrangements
- Manners of pillar extraction- Slicing method & Stook method, Line of extraction – different types with pros and cons, Types of pillar extraction in a panel, Different challenges in depillaring and precautions to be taken
- Simple layouts of Depillaring methods in Bord and Pillar

### **Unit- III Longwall Mining**

- Application of Longwall Mining; Longwall Mining vs Bord & Pillar Mining- Advantages & Disadvantages
- Length and Direction of a Longwall Face- factors to be considered

- Terminologies associated with a longwall panel; Different types of longwall working- Advancing & Retreating; Cyclic & Non- cyclic- advantages and disadvantages; Comparison between Advancing & Retreating Methods
- Development of longwall panel- use of Roadheader in development, preparatory arrangements for a longwall face
- Longwall layouts - basic idea only
- Different machineries like Power Support, AFC, Shearer, Plow, Stage Loader- operational aspects only
- Challenges associated with longwall workings.

#### Unit- IV Stowing

- Conditions at which Stowing is practised; Advantages of stowing
- Different types of stowing- Hand packing, Hydraulic Stowing, Pneumatic & Mechanical Stowing
- Procedures with equipments for different types of stowing; Troubles during stowing operations
- Layouts of Bord & Pillar Depillaring with stowing and Longwall Retreating with stowing

#### Suggested learning resources:

1. Elements of Mining Technology, Vol 1, D.J. Deshmukh, Denet Publications, Nagpur
2. Das, S. K., Modern Coal Mining Technology, Lovely Prakashan, Dhanbad, 1992
3. Singh, R. D., Principles & Practices of Modern Coal Mining, New Age International, New Delhi, 1997
4. Singh, T. N., Underground winning of Coal, Oxford and IBH, New Delhi, 1992
5. Statham, I. C. F., Coal Mining Practice, Caxton eastern agencies, Calcutta, Reprint, 1964

#### Course outcomes:

After completing this course, students will be able to:

- Select the proper method of working in given conditions.
- Design a Bord and Pillar development district.
- Design a Bord and Pillar depillaring district.
- Design a simple layout of a coal mine.
- Design layout of a mine having a Longwall method of working.
- Explain operational aspects of various machineries deployed in underground coal mines.
- Describe different stowing techniques.

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Course Code	:	MINPC 305
Course Title	:	Surface Mining
Number of Credits	:	3 (L : 3, T : 0, P : 0)
Prerequisites	:	Basic knowledge in Mathematics, Physics, Chemistry and Engineering Graphics

Course Category	:	PC
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**TOPIC WISE DISTRIBUTION OF THE COURSE:**

UNIT	TOPIC	LECTURE PERIODS	TUTORIAL PERIODS
I	<b>Introduction to Surface Mining</b>	6	0
II	<b>Opening of a mine</b>	9	0
III	<b>Classification of Surface Mines ( basic concept only)</b>	3	0
IV	<b>Different machineries used in Opencast Mines</b>	15	0
V	<b>Opencast layout</b>	6	0
VI	<b>Haul Road and Spoil Bank</b>	3	0
VII	<b>Land Reclamation</b>	3	0

**Course Objectives:**

Following are the objectives of this course:

- To get introduced to the subject with Pros and Cons and to become familiar with different terms.
- To understand the procedure of mine opening.
- To become familiar with classification of Surface mines.
- To know about different machineries required for different mining activities.
- To understand the layout of surface mines.
- To know about the basic construction and safety arrangements of haul road and stability of spoil banks.
- To understand the concept of land reclamation.

**UNIT- I Introduction of Surface mining**

- Definition of Surface mining, Applicability
- Advantages and disadvantages
- Concept of bench , bench height , bench width, Bench slope angle, Average slope , ultimate pit slope.
- Coal : OB thickness ratio , stripping ratio, break-even stripping ratio, Factors controlling break-even stripping ratio and its improvement.

**UNIT-II Opening of a mine**

- Site preparation, Box cut , Location of Box cut

- Factors affecting height & width of bench, Bench height and width in Manual and mechanized opencast working.
- Bench Slope : Slope stability- basic concept on structural Geological Information, Geomechanical Information , Ground Water / Geohydrography , Dynamic loading.

#### **UNIT- III Classification of Surface Mines ( basic concept only):**

- Continuous mining, Semicontinuous mining, Discontinuous or cyclic mining

#### **UNIT- IV Different machineries used in Opencast Mines**

- **Single bucket excavators:**
  - **Shovel** – Description, Field of application, Principles of operation. Bucket fill factor, cycle time, angle of swing factor.
    - Bucket capacity calculation with the following data – cycle time, density of material ( in tonne per cubic meter) , bucket fill factor and output target ( of the machine) in tonne / hour.
  - **Dragline** - Description, Principles of operation and cycle of operation.
- **Multi-bucket excavator:**
  - **Bucket wheel excavator** - Description, Field of application, Principles of operation.
- **Surface miner** - Applicability and Limitations, Principles of operation
- **Dumpers:** Description, Operation and safety features
- **Dozers:** Description, Operations and field application
- **Auxiliary equipments:** Different auxiliary equipments used in opencast mines with operations;
- **Different combinations of earth moving machineries.**

#### **UNIT- V Opencast layouts**

- Layout with Shovel-Dumper combination
- Spiral layout

#### **UNIT- VI Haul Road and Spoil Bank**

- Construction, Safety arrangements and Advantages of good haul road;
- Spoil bank – Stability and Safety measures .

#### **UNIT- VII Land Reclamation**

- Objectives
- Methods

#### **Suggested learning resources:**

1. Surface Mining Technology – S.K.Das
2. Surface Mining – G.B.Misra
3. Elements of mining technology (Vol-I ) - D.J.Deshmukh
4. Principles and Practices of Modern Coal Mining – R.D.Singh
5. C.M.R. 2017

#### **COURSE OUTCOMES:**

After completing this course, students will be able to:

- Understand as to where such Surface mining operation to be conducted and use different terms related to this operation.

- Carry out different mining operations in sequential manner.
- Classify Surface Mining Practice.
- Take the decision to deploy different HEMMs in different mining operations.
- Layout opencast mine under different mining conditions.
- Construct good haul roads and take preventive safety measures in spoil banks.
- Carry out Land reclamation procedure during and after mining operation.

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Course Code	:	MINPC 306
Course Title	:	Mining Geology
Number of Credits	:	2 (L : 2, T : 0, P : 0)
Prerequisites	:	Basic knowledge in Physics, Chemistry & Engineering Graphics
Course Category	:	PC

#### TOPIC WISE DISTRIBUTION OF THE COURSE:

UNIT	TOPIC	LECTURE PERIODS	TUTORIAL PERIODS
I	<b>Basic Geology</b>	4	0
II	<b>Mineralogy</b>	6	0
III	<b>Stratigraphy</b>	10	0
IV	<b>Economic Geology</b>	6	0
V	<b>Geological Mapping</b>	4	0

#### Course Objectives:

Following are the objectives of this course:

- To have an introductory idea about the science of the Earth.
- To know about different minerals and their crystal systems.
- To have an idea of Stratigraphy.
- To study historical geology of different important regions in India.
- To learn about different coalfields and mineral deposits in India.
- To have an introductory concept about Geological Mapping.

## **Course Content:**

### **Unit- I Basic Geology**

- Study of Geology- Its importance and interest
- Brief idea about origin, age & interior of the Earth
- Branches of Geology- their brief description
- Physical Geology –Name of different natural agencies working on the surface of the Earth. Definition of Weathering, Erosion, Mantle and Denudation

### **Unit- II Mineralogy**

- Mineralogy- Definition of Crystal & Mineral, Ore Minerals & Rock forming Minerals
- Study of Crystals- Crystal, Crystalline & Amorphous substances, Different kinds of symmetry, Different Crystal systems
- Physical properties of minerals

### **Unit- III Stratigraphy**

- Brief idea about Stratigraphy; Principles of stratigraphy and Correlation, Stratigraphic units; Geological divisions of India, Physiographic divisions of India- brief description;
- Geological time scale –including Indian system
- Precambrian Study- brief idea; Generalised classification & correlation of Archean and Lower Proterozoic formation of India;
- Study in brief Precambrian Stratigraphy of the following regions of Indian sub-continent;
  - Karnataka
  - Rajasthan
  - Singhbhum
- Stratigraphy of the Gondwana system in brief- Gondwana Climate and Sedimentation, Classification; Lower Gondwana coal fields- brief description of different formations

### **Unit- IV Economic Geology**

- Definition of Ores, Ore minerals, Gangue minerals, Tenor, Grade, Metallogenic epoch, Metallogenic province.
- Brief geological idea about the following mineral deposits in India:
  - Singhbhum Copper & Iron ore deposit
  - Manganese deposit of Madhya Pradesh
  - Gold deposit of Karnataka.
- Coal; Difference between Lower-Gondwana and Tertiary Coals
- Brief geological idea about the-
  - Jharia Coalfield
  - Raniganj Coalfield.

### **Unit- V Geological Mapping**

- Definition- Contour map and Geological map. Recognition of the following structures: Horizontal, Inclined and Vertical beds, Folds, Faults, Unconformities, Dykes, Silts on geological maps.
- Description of a Geological Map



**Suggested learning resources:**

1. Mukherjee, P. K., A TextBook of Geology, The World Press Pvt. Ltd., 9th Edition, 1982
2. Elements of Mining Technology, Vol 1, D.J. Deshmukh, Denet Publications, Nagpur
3. Singh, P., Geology for Engineers, IBH Publications, N. Delhi. 1991.
4. Holemess, A., Principles of Physical Geology, Thomas Nelson and Sons, USA, 1964.
5. Ford, W. E., Dana's Textbook of Mineralogy (4th edition), Wiley Eastern Ltd., N. Delhi, 1989.
6. Winter, J. D., An Introduction to Igneous and Metamorphic Petrology, Prentice Hall, N. Delhi, 2001.
7. Billings, M. P., Structural Geology, Prentice Hall Ino., N. Jersey, USA, 1972.
8. Krishnan, M. S., Geology of India and Burma, 3rd Edition, IBH Publishers, N. Delhi, 1984.
9. Blyth, F. G. H. and de Freitas, M. H., Geology for Engineers, 7th edition, Elsevier Publications, 2006.
10. Bell, F. G., Engineering Geology, Elsevier Publications, 2007.

**Course outcomes:**

After completing this course, student will be able to:

- State the scope and applications of Geology.
- Explain about the minerals and their crystal systems.
- Explain the historical geology of the Earth and Geological Time Scale.
- State geological and physiographic divisions of India.
- Apply geological knowledge to correlate different coalfields and mineral deposits in India.
- Interpret Geological Maps.

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Course Code	:	MINPC 311
Course Title	:	Underground Mine Environment Lab.
Number of Credits	:	1 (L : 0, T : 0, P : 2)
Prerequisites	:	Basic knowledge in Physics, Chemistry & Engineering Graphics
Course Category	:	PC

**Course Objectives:**

Following are the objectives of the course-

- To learn about different types of flame safety lamps (FSL) and different parts of a FSL.

- To learn about the use of FSL for accumulation test and percentage test of inflammable gas in mine air.
- To know the use of Methanometer and CO-detector.
- To determine the environmental condition with Kata thermometer, Hygrometer and Whirling hygrometer.

**List of practicals to be performed:**

Sl. No	Name of the practicals to be performed
1	Study of different types of flame safety lamps and their different parts
2	Use of FSL for accumulation test and percentage test of inflammable gas
3	Disassembling and assembling of Flame Safety Lamp
4	Study of Methanometer
5	Study of CO-detector
6	Determination of cooling power of atmospheric air using Kata Thermometer
7	Measurement of relative humidity using Fixed Hygrometer and Whirling Hygrometer

**Suggested learning resources:**

1. Deshmukh D.J. (2007): Elements of Mining Technology Vol. 2. (9th Edition). Denett & Company, Nagpur.
2. G. B. Misra : Mine Environment and Ventilation , OXFORD UNIVERSITY PRESS
3. Kaku L. C (2021): A study of Mine Management Legislation & General Safety, Lovely Prakashan, Dhanbad
4. McPherson M J (1993): Subsurface Ventilation Engineering (web edition). Downloadable from <http://www.mvsengineering.com>
5. McPherson M J (2009): Subsurface Ventilation and Environmental engineering (2nd edition). Chapman and Hall,
6. Ramlu M A (2007): Mine Disasters and Mine Rescue. (2nd Edition). Universities Press, Hyderabad.
7. Sengupta D.K (2020): Gas Testing Reference Book, Gita Book Store, Chanda

**Course outcomes:**

After completing this course, students will able to:

- Identify different types of FSL and its different parts with disassembling and assembling.
- Demonstrate the procedure of accumulation test and percentage test of inflammable gas in air using FSL.
- Use a Methanometer and CO-detector to detect Firedamp and Carbon Monoxide respectively.
- Determine Cooling power and relative humidity of air.

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Course Code	:	MINPC 312
Course Title	:	Drilling & Blasting Lab.
Number of Credits	:	1 (L : 0, T : 0, P : 2)
Prerequisites	:	Basic knowledge in Physics, Chemistry & Engineering Graphics
Course Category	:	PC

**Course Objectives:**

Following are the objective of this course:

- To know different types of drill bits & drill rods used in mines.
- To learn different shot hole patterns in coal and rock headings.
- To have an idea about explosives & accessories used in U/G & O/C mines
- To learn blasting patterns in underground mines.
- To learn drilling & blasting patterns in opencast mines.

**List of practicals to be performed:**

1	Study & sketch of different types of drill bits.
2	Study & sketch of different types of drill rods.
3	Study & sketch of different shot hole patterns used in coal & rock heading.
4	Study & sketch of circuit testers.
5	Study & sketch of exploders.
6	Study & sketch of stemming rod, scraper cum break detector, blasting cable, crimper
7	Study & sketch of blasting pattern in shaft sinking
8	Study & sketch of single row blasting pattern
9	Study & sketch of multi row blasting pattern
10	Study of blast design parameters of the opencast bench.

**Suggested learning resources:**

1. Elements of Mining Technology, Vol 1, D.J. Deshmukh, Denet Publications, Nagpur
2. Explosive and Blasting practices in mines, Samir Kumar Das, Lovely Prakashan, Dhanbad
3. Principle & Practices of Coal Mining, R.D. Singh
4. Surface Blast Design. Konya K. J. and Walter E. J. Prentice Hall. 303 p.
5. Fundamentals of Drilling Engineering. Society of Petroleum Engineers. Mitchell R. F. and Miska S.
6. Pradhan G. K. and Sandhu M. S.2002. *Blasting Safety Manual*. IME Publications

**Course outcomes:**

After completing this course, student will be able to:

- Select and know the use of different drill bits and drill rods for given conditions.
- Select suitable drill patterns for various rock conditions.
- Use different types of explosives in mines.
- Perform blasting operations in U/G mines.
- Perform blasting operations O/C mines.

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Course Code	:	MINPC 313
Course Title	:	Mining Operations Lab
Number of Credits	:	1 (L : 0, T : 0, P : 2)
Prerequisites	:	Basic knowledge of different methods of mining operations, Physics, Chemistry, Mathematics & Engineering Graphics
Course Category	:	PC

**Course Objectives:**

Following are the objectives of this course:

- Learn Working & Layout of Bord and Pillar Mining method.
- Learn Working & Layout of Longwall Mining method.
- Learn different layouts of stowing operations.
- Understand the opening of a Surface Mine.
- Idea about different widely used layouts of Surface Mining operations.
- Learn different tunneling methods.

**List of practicals to be performed:**

1.	Study and Sketch of Bord & Pillar development workings.
2.	Study and Sketch of Bord & Pillar depillaring with caving.
3	Study and Sketch of Mechanized Advancing Long-wall workings.
4.	Study and Sketch of Mechanized Retreating Long-wall workings.
5.	Study and Sketch of Bord & Pillar Depillaring with Stowing
6.	Study and Sketch of Longwall Retreating with Stowing
7.	Study and Sketch of Box cut (External and Internal).
8.	Study of Opencast layout with Shovel-Dumper combination.
9.	Study and Sketch of Dragline Operation.

**Suggested learning resources:**

1. Elements of Mining Technology, Vol 1, D.J. Deshmukh, Denet Publications, Nagpur
2. Introduction to Mining, G.K.Pradhan, Mintech Publications, Bhubaneswar
3. Principle & Practices of Coal Mining, R.D. Singh

**Course outcomes:**

After completing this course, student will be able to:

- Design layout of Development of Bord and Pillar methods of working.
- Design layout and explain the Depillaring of Bord and Pillar method of working.
- Design layout of Advancing and Retreating Longwall methods of working.
- Explain stowing techniques for different Methods of Working.
- Explain the opening of a Surface Mine by Box cut.
- Explain the different tunneling methods.

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Course Code	:	MINPC 314
Course Title	:	Mining Geology Lab.
Number of Credits	:	2 (L : 0, T : 0, P : 2)
Prerequisites	:	Basic knowledge in Physics, Chemistry & Engineering Graphics

Course Category	:	PC
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### Course Objectives:

Following are the objectives of this course:

- To identify different rocks by naked or by use of minor aids.
- To identify different minerals by naked eye.
- To know how to interpret geological maps.

### List of practicals to be performed:

#### 1. Petrology

- a. Identification and description of igneous rocks – plutonic, hypabyssal and volcanic type of rocks
- b. Sedimentary rocks – rudites, arenites, carbonates and argillites
- c. metamorphic rocks – gneiss, marble, slate, schist, quartzite.

#### 2. Mineralogy

- a. Identification of physical properties of quartz and feldspar varieties, hypersthene hornblends, augite, mica, asbestos, barite, calcite, fluorite, tourmaline, beryl.
- b. Study of Moh's scale of hardness.

#### 3. Study of Geological Maps

- a. Topo sheets- basic concept only
- b. Study of different codes, colours and symbols generally shown in the geological maps- rocks and geological structures like folds, faults, unconformity, igneous intrusions etc.
- c. Interpretation of contour maps.
- d. Description of a simple type of geological map.
- e. To draw a section from a simple geological map having simple structures as above.

### Suggested learning resources:

1. A textbook of Geology by P. K. Mukherjee
2. Elements of Mining Technology, Vol 1, D.J. Deshmukh, Denet Publications, Nagpur
3. Elements of Mining Technology, Vol 1, D.J. Deshmukh, Denet Publications, Nagpur
4. Singh, P., Geology for Engineers, IBH Publications, N. Delhi. 1991.
5. Holemess, A., Principles of Physical Geology, Thomas Nelson and Sons, USA, 1964.
6. Ford, W. E., Dana's Textbook of Mineralogy (4th edition), Wiley Eastern Ltd., N. Delhi, 1989.
7. Winter, J. D., An Introduction to Igneous and Metamorphic Petrology, Prentice Hall, N. Delhi, 2001.
8. Krishnan, M. S., Geology of India and Burma, 3rd Edition, IBH Publishers, N. Delhi, 1984.
9. Blyth, F. G. H. and de Freitas, M. H., Geology for Engineers, 7th edition, Elsevier Publications, 2006.
10. Bell, F. G., Engineering Geology, Elsevier Publications, 2007.

**Course outcomes:**

After completing this course, student will be able to:

- Identify different rocks that are found in the mining areas.
- Identify different minerals by their physical properties.
- Interpret a Geological map.

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Course Code	:	MINSI 341
Course Title	:	Internship- I
Number of Credits	:	1 (L : 0, T : 0, P : 0)
Prerequisites	:	Basic knowledge in Physics, Chemistry & Engineering Graphics
Course Category	:	SI

**Procedures to be observed:**

Students are required to be involved in Inter/ Intra Institutional activities viz., Training and Simulation program with different Institutes like Workshop of ITI, Other Polytechnics or other Technical Institutions; Soft Skill Training organized by Training & Placement Cell of the Institution; Contribution at Innovation/ Entrepreneurship Cell of the Institute; Participation in workshops/ competitions etc.; Learning at Departmental Lab./ Institutional Workshop or Vocational Training in the concerned Industry.

After completion of the Internship, the students should-

- Prepare a comprehensive report to indicate what he/ she has observed and learnt during the training period.
- The students may contact Industrial Supervisor/ Manager/ Internship Faculty Mentor/ TPO for assigning topics & problems and should prepare the final report on the assigned topics.
- The training report should be signed by the Industrial Supervisor/ Manager/ Internship Faculty Mentor/ TPO and HOD.
- Present the final report on the assigned topics in a seminar, before an internal committee constituted by the department.

Normally this Internship/ Training will be undertaken immediately after completion of the second semester (during the summer vacation ).

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