

West Bengal State Council of Technical &  
Vocational Education and Skill  
Development  
(Technical Education Division)



Syllabus  
of

Diploma in Mining Engineering [MIN]

Part-II (4<sup>th</sup> Semester)

Revised 2022

## Detailed Curriculum Contents for Diploma in Mining Engineering

### SEMESTER IV

Sl. No	Category	Code No.	Course Title	Hours per week			Total contact hrs/ week	Credits	Marks
				L	T	P			
1.	Program core course	MINPC 401	Mine Ventilation	3	0	0	3	3	100
2.	Program core course	MINPC 402	Underground Metalliferous Mining	2	0	0	2	2	100
3.	Program core course	MINPC 403	Mine Survey-I	3	0	0	3	3	100
4.	Program core course	MINPC 404	Elementary Rock Mechanics & Strata Control	2	0	0	2	2	100
5.	Program core course	MINPC 405	Electro- technology in Mining	2	0	0	2	2	100
6.	Program core course	MINPC 411	Mine Ventilation Lab.	0	0	2	2	1	100
7.	Program core course	MINPC 412	Mine Survey-I Lab.	0	0	4	4	2	100
8.	Program core course	MINPC 413	Strata Control Lab.	0	0	2	2	1	100
9.	Program core course	MINPC 414	Electro- technology in Mining Lab.	0	0	2	2	1	100
10.	Program elective course	MINPE 42*	Elective-I	2	0	0	2	2	100
a.	ANY ONE COURSE HAS TO BE TAKEN FROM a & b	MINPE 421	Special Underground Mining						
b.		MINPE 422	Surface Mining-II						
11.	Minor Project	MINPR 451		0	0	4	4	2	100
<b>TOTAL</b>							<b>28</b>	<b>21</b>	<b>1100</b>

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

Course Code	:	MINPC 401
Course Title	:	Mine Ventilation
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>Air flow through mine openings</b>	6	0
II	<b>Natural Ventilation</b>	9	0
III	<b>Mechanical Ventilation</b>	12	0
IV	<b>Distribution and control of air currents</b>	10	0
V	<b>Ventilation Survey &amp; Air Conditioning</b>	8	0

### Course Objectives:

Following are the objectives of this course:

- To get familiar with the necessity of ventilation in a mine and different instruments used in mines for the purpose of maintaining adequate ventilation.
- To learn about Natural Ventilation in the belowground mine.
- To learn about artificial ventilation in mine by different fans and to be familiar with different laws related to mine ventilation.
- To know about the methods of distribution & control of air current in belowground mines.
- To get familiar with the process of ventilation survey in belowground mines and air conditioning.

### Course Content:

#### Unit- I Air flow through mine openings

- Objective of Mine Ventilation and Standard of ventilation.
- Quantity of air required for ventilation of a mine; Quality of air; Minimum velocity of air current.
- Instruments used to measure the adequacy of ventilation – Thermometer, Barometer, Anemometer, Water gauge, Pitot tube, Hygrometer, Kata- thermometer.

## **Unit- II Natural Ventilation**

- Factors affecting Natural Ventilation; Effect of depth, temperature, pressure, seasonal variations etc. on Natural Ventilation
- Natural Ventilation Pressure (NVP)
- Calculation of NVP from air densities
- Numerical Problems - Calculation of motive column and N.V.P. with given shaft depth, shaft temperature and average barometric Pressure

## **Unit- III Mechanical Ventilation**

- Types of mine fan; Centrifugal fan and Axial flow fan – comparison between them
- Selection of mine fan and control of quantity of air delivered; Characteristics Curves
- Fans in series and parallel
- Forcing and exhaust fan, Reversal of air current after fire - conditions
- Fan Evasee; Numerical problem on head recovery in Evasee with given efficiency of head recovery in evasee, velocity of air at fan outlet and Evasee outlet.
- Laws of mine air friction – numerical problems
- Laws relating to quantity of air, water gauge and fan speed – numerical problems; Theoretical depression and Effective depression; Manometric efficiency; Air Power; Mechanical efficiency; Equivalent Orifice of a mine.
- Standing order in the event of stoppage of the main mechanical ventilator in mines.

## **Unit- IV Distribution and control of air currents**

- Ventilation stoppings, air crossings, ventilation doors, regulators, brattice partitions, airlocks at pit-top
- Splitting of air current, Numerical problems on splitting
- Ventilation of headings; Auxiliary fan; Ducts for auxiliary ventilation
- Booster fan and neutral line; Simple numerical problems on booster fan
- Sources of leakage of air
- Ventilation district
- Ascensional and Descensional ventilation, Homotropical and Antitropical ventilation, Central and Boundary ventilation

## **Unit- V Ventilation Survey & Air Conditioning**

- Objectives of ventilation survey
- Quantity Surveying, Pressure Surveying, Instruments used
- Smoke generator for low velocity air current
- Problem of Ventilation in deep mines and suggested measures
- Air conditioning

**Suggested learning resources:**

1. Deshmukh D J., Elements of Mining Technology – Vol 2
2. Mishra, G. B., Mine Environment and Ventilation, Oxford University Press, Fifth Impression, 1993
3. Mine Ventilation and Air Conditioning, Wiley-interscience, 3rd Edition, 1997
4. Banerjee, S. P., Mine Ventilation, Lovely Prakashan, 1st Edition, 2003
5. CMR 2017 and DGMS circulars

**Course outcomes:**

After completing this course, student will be able to:

- Understand the need for adequate ventilation in mines and also use different instruments connected with the ventilation system in mines.
- Explain natural ventilation in mines .
- Select the right fan for the mine and get desired performance from known performance of fan by using Fan laws.
- Explain the method of air distribution in mines and provide adequate ventilation in mine districts and headings.
- Carry out ventilation surveys in mines and take necessary action to provide a comfortable atmosphere to work persons.

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Course Code	:	MINPC 402
Course Title	:	Underground Metalliferous 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
<b>I</b>	<b>Introduction</b>	4	0
<b>II</b>	<b>Mode of entry</b>	4	0

<b>III</b>	<b>Stone Drifting</b>	2	0
<b>IV</b>	<b>Mine Development</b>	6	0
<b>V</b>	<b>Sampling in Metal Mines</b>	4	0
<b>VI</b>	<b>Stoping Methods</b>	10	0

### **Course Objectives:**

Following are the objectives of this course:

- To become familiar with ore deposits of metalliferous mines.
- To know different metal mining terminologies.
- To understand different methods of entries to an underground Metal Mine.
- To understand stone drifting and blasting patterns in stone.
- To understand the development of an underground metal mine.
- To know different sampling methods in metal mining.
- To have knowledge about different mining methods under different geo-mining conditions.

### **Course Content:**

#### **Unit-I Introduction**

- Present status of Metal Mining sector particularly in India.
- Geological conditions and characteristics of ore deposit.
- Important Metal Mining Terminologies.
- Coal Mining vs Metal Mining.

#### **Unit-II Mode of Entry**

- Adit, Tunnel, Ramp -Application, Advantage & Disadvantage
- Vertical shaft, Incline, Vertical shaft in ore, Vertical shaft Hang wall, Vertical Shaft in Hang wall, Comparison between vertical and incline shaft ,Shaft pillar
- Mode of entry related regulations.

#### **Unit-III Stone Drifting**

- Application of stone drifting, Method of driving drift, Different patterns of shot holes for blasting - Burn Cut, Coromant Cut, Ring drilling, Fan Cut, Drag cut, Cone cut & Wedge Cut.

#### **Unit-IV Mine Development**

- Salient points to be considered at the time of development.
- Different Raising Methods- Open Raising, Double Compartment Raising, Drop Raising/Long Hole Raising, Alimak Raising, Jora Raising, Raise Boring

- Development of Drive, Cross cut, Winze,
- Ore Bin, Brow Bin, Kimberley chute, Ore Pass, Shaft Station, Grizzly, Secondary breaking at grizzly, Underground Chambers

**Unit-V Sampling in Metal Mines**

- Objectives and Principles; Classification of sampling methods, Channel sampling, Chip sampling, Bulk sampling, Drill sampling, Grab Sampling , Car sampling
- Salting, Assaying and Assay Map, Coning & Quartering

**Unit-VI Stopping Methods**

- Selection of stopping methods; Classification of stopping methods- Underhand stoping, Overhand stoping, Breast stoping, Shrinkage stoping, Cut & fill stoping, Post-pillar method of stoping, Sub-level stoping- Application, Preparation, Workings, Merits & Demerits.
- Elementary idea on Square set stoping, Top slicing, Sublevel caving and block caving

**Suggested learning resources:**

1. Deshmukh D. J. (2010) Elements of Mining Technology. Vol.1&2 (8th Edition). Denett and Company, Nagpur.
2. Kannavena S. (2017) Advanced Metal Mining Methods. (1<sup>st</sup> Edition). Planet Book House, Kothi
3. Chacharkar. Y.P. (1994) A Study of Metalliferous Mining Methods. (1<sup>st</sup> Edition). Lovely Prakashan, Ddanbad
4. Hartman Howard L. (1992). SME Mining Engineering Handbook. Vol.1(2<sup>nd</sup> Edition). Society for Mining, Metallurgy, and Exploration, Inc. Littleton, Colorado

**Course outcomes:**

After completing this course, student will be able to-

- Differentiate Coal and Metal Mining
- Distinguish and use different approaches to underground ore bodies
- Understand & Use different blasting patterns in different rock conditions.
- Understand and supervise different drive, cross cut, raising, winzing etc. methods in underground
- Identify and use different sampling methods.
- Identify and use different underground methods of operation practised in the Metal Mining Industry.

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Course Code	:	MINPC 403
Course Title	:	Mine Survey- I

Number of Credits	:	3 (L : 3, T : 0, P : 0)
Prerequisites	:	Basic knowledge in Mathematics & Engineering Graphics
Course Category	:	PC

### TOPIC WISE DISTRIBUTION OF THE COURSE:

UNIT	TOPIC	LECTURE PERIODS	TUTORIAL PERIODS
I	<b>Overview and Classification of Survey</b>	6	0
II	<b>Chain Surveying</b>	8	0
III	<b>Levelling</b>	14	0
IV	<b>Contouring</b>	4	0
V	<b>Theodolite</b>	13	0

### Course Objectives:

Following are the objectives of this course:

- To understand types of surveying works required.
- To know chain surveying.
- To know the use and operational details of different levelling equipment.
- To know about different aspects of contouring.
- To know the use and operational details of a Theodolite.

### Course Content:

#### Unit- I Overview and Classification of Survey:

- Survey- Purpose and Use
- Types of surveying- Primary and Secondary, Classification: Plane, Geodetic, Cadastral, Hydro-graphic, Photogrammetry and Aerial
- Principles of Surveying
- Scales: Engineer's scale, Representative Fraction (RF) and diagonal scale.
- Ranging, Chaining on flat ground and sloping ground; Sources of errors in ordinary chaining.
- Basic concept of traversing

#### Unit- II Chain Surveying



- Principles of chain surveying. Concept of check line, tie line etc.; Method of taking off-sets
- Field party, Reconnaissance, equipment for field work, selection of stations, well- conditioned triangles, marking stations, chaining distance, field book writing, conventional signs.
- To select a perpendicular to a chain line from a point on it; To drop a perpendicular to a chain line from a point outside it; To run a parallel to a chain line through a given point; Obstacles to ranging, obstacles to chaining and to both.
- Error & correction in chain survey, accuracy- Numerical problems.

### **Unit- III Levelling**

- Definitions of terms used in levelling; Levelling instruments and staff; Parts and functions of dumpy level, tilting level and automatic level.
- Methods of levelling
- Principles and methods of spirit levelling.
- Principles and methods of differential levelling.
- Reciprocal levelling
- Methods of booking, calculation of reduced levels
- Numerical problems
- Effect of curvature & refraction in levelling; Sources of errors, precautions and permissible errors in levelling

### **Unit- IV Contouring**

- Purpose of contouring , contour lines, contour intervals, factors governing contour intervals.
- Characteristics of contour; Method of contouring; Interpolation of contours, contour gradient
- Use of contour in plans & maps.
- Components and use of Digital Planimeter.
- Measurement of area using Digital Planimeter.

### **Unit- V Theodolite**

- Classification of theodolite, application of theodolite; Transit vernier theodolite - different parts and their function
- Geometric relationship of different axes; Adjustment of theodolite - temporary & permanent.
- Method of measuring horizontal angles- Repetition and Reiteration methods; Measurement of vertical angles
- Theodolite traversing by different methods on surface and underground.
- Continuous azimuth method
- Double foresight method
- Backsight and foresight method
- Computation of traverse results- Area of traverse, calculation of closing error,
- Adjustment of Closed Traverse: (i) Distribution of angular errors; (ii) Balancing the traverse by Bowditch's Rule and Transit Rule.
- Numerical problems.

- Basic principle of Gyro theodolite and its application in mining.

**Suggested learning resources:**

1. Punmia, B.C.; Jain, Ashok Kumar; Jain, Arun Kumar, Surveying I, Laxmi Publications, New Delhi.
2. Basak, N. N., Surveying and Levelling, McGraw Hill Education, New Delhi.
3. Kanetkar, T. P.; Kulkarni, S. V; Surveying and Levelling ; Volume I, Pune Vidyarthi Gruh Prakashan.
4. Duggal, S. K., Survey I, McGraw Hill Education, New Delhi.
5. Saikia, M D.; Das. B.M.; Das. M.M., Surveying, PHI Learning, New Delhi.
6. Subramanian, R., Fundamentals of Surveying and Levelling, Oxford University Press. New Delhi.
7. Rao, P. Venugopala Akella, Vijayalakshmi, Textbook of Surveying, PHI Learning New Delhi.
8. Bhavikatti, S. S., Surveying and Levelling, Volume 1, I. K. International, New Delhi.
9. Arora K R , Surveying Vol. I, Standard Book House.
10. Mine Surveying and Levelling, Vol 1, S Ghatak, Lovely Prakashan
11. Mine Surveying and Levelling, Vol 2, S Ghatak, Lovely Prakashan
12. Mine Surveying and Levelling, Vol 3, S Ghatak, Lovely Prakashan

**Course outcomes:**

After completing this course, student will be able to:

- Select the type of survey required for a given situation.
- Compute area of open field using chain, tape and cross staff.
- Use levelling instruments to determine reduced level for preparation of contour maps.
- Use a digital planimeter to calculate the areas.
- Conduct traversing in the field using a theodolite.

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Course Code	:	MINPC 404
Course Title	:	Elementary Rock Mechanics & Strata Control
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>Elementary Rock Mechanics</b>	6	0
II	<b>Conventional Support System</b>	8	0
III	<b>Additional Support System</b>	6	0
IV	<b>Strata Monitoring Measures</b>	4	0
V	<b>Subsidence</b>	6	0

### Course Objectives:

Following are the objectives of this course:

- To have elementary knowledge of Rock Mechanics.
- To understand the characteristics of various materials used for supporting material.
- To understand the ground movement and its controlling techniques.
- To learn the behaviour of rock under extraction and required support systems thereof.
- To become familiar with different types of strata monitoring measures
- To familiar with the subsidence occurs due to mining activity

### Course Content:

#### Unit-I Elementary Rock Mechanics

- Rock Mechanics, Rock & Rock Mass- Definitions, Basic concepts; Application of rock mechanics in mines; Definition of Stress & Strain, Different stresses that act on a block of rock- Names & Definitions; Relation between vertical stress and horizontal stress.
- Stress Distribution around a narrow & wide openings (Pressure arch theory in Bord & Pillar working & in Longwall working)
- Rock Quality Designation (RQD) & Rock Mass Rating (RMR)- Different elements, Applications.
- Different types of Slope failure occurs in opencast mines

#### Unit-II Conventional Support System

- Introduction- Factors affecting the strata behaviour; Requirements of Strata Controlling; Factors to be taken care of in Strata Control Measures; Steps to be taken for controlling strata.
- Properties of various types of roofs; Materials used for support in mines, Classification of mine supports.

- Setting of timber props, Bars, Cogs, Side supports; Tapered props, Forepoling, Prop density, Prop load, Factors influencing prop load; Safari Supports
- Support for roadway junction; Clearing up of heavy roof-fall; Withdrawal of supports; Erection of temporary support; Re-setting of supports; Dressing operation in coal mines
- Definition of different terms like Setting Load, Yield Load, Bearing Capacity, Characteristic Curve etc.
- Roof Bolts- Roof bolt, Principles of operation, Method of roof bolting, Specifications of roof bolts; Essential elements of roof bolting; Resin/ Cement Capsule Bolting, Bolt density, Advantage & disadvantages of roof bolt support; Causes of roof bolt failure, Effectiveness of roof bolt; Different type rock bolts; Cable Bolt; Application of Floor bolting

### **Unit-III Additional Support System**

- Steel Arches, Screw Props, Chocks, Mesh, Shotcreting, Concrete or bricks support, Roof-stitching, Bamboo bolting- Brief description & Application
- Hydraulic and Friction Props- Principles of operation, Description and Comparison
- Frame support, Chock support, Shield support & Chock Shield support: Classification; Constructional features; merits demerits and applications; Hydraulic fluids; Power Pack.

### **Unit-IV Strata Monitoring Measures**

- Concepts of SCAMP as per CMR 2017
- Testing of roof; Monitoring of support performance- Anchorage Testing- brief idea
- Strata Monitoring Instruments- operational aspects only.

### **UNIT-V Subsidence**

- Different theories of Subsidence, Subsidence over Bord & Pillar workings
- Angle of draw, Magnitude of Subsidence- Factors affecting subsidence
- Critical area of extraction,
- Subsidence damage, Prevention of Subsidence damage to surface structures (basic ideas only)

### **Suggested learning resources:**

1. Deshmukh D. J. (2010) Elements of Mining Technology. Vol.1 (8th Edition). Denett and Company, Nagpur.
2. Singh R D (1997) Principles and Practices of Modern Coal Mining. New AgePublisher, New Delhi.
3. Rock Mechanics, by Richard E. Goodman
4. Rock mechanics and strata control, by B.S.Varma
5. Rock Mechanics & Ground Control, by D. Biswas, Lovely Prakashan, Dhanbad.
6. Gorai A.K (2018) A complete guide for Mining Engineers, Lovely Prakashan , Dhanbad
7. Miner's Handbook by Ali Murtoja Shaikh
8. CMR 2017 & relevant DGMS Circulars

**Course outcomes:**

After completing this course, student will able –

- To understand the behaviour of rock under extractions.
- To select the required support systems for underground mines.
- To get familiar with the support plan and support performance.
- To use different strata monitoring instruments.
- To understand the causes and effects of subsidence in mining and take necessary precautions.

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Course Code	:	MINPC 405
Course Title	:	Electro-technology in Mining
Number of Credits	:	2 (L : 2, T : 0, P : 0)
Prerequisites	:	Basic knowledge in Mathematics, Physics & Chemistry
Course Category	:	PC

**TOPIC WISE DISTRIBUTION OF THE COURSE:**

UNIT	TOPIC	LECTURE PERIODS	TUTORIAL PERIODS
I	<b>Introduction to Electrical Power</b>	4	0
II	<b>DC Machines</b>	10	0
III	<b>AC Machines</b>	8	0
IV	<b>Storage Batteries (Lead Acid cell)</b>	4	0
V	<b>Electrical Hazards (Shock &amp; Fire) and Earthing</b>	4	0

**Course Objectives:**

Following are the objectives of this course:

- To have an introductory idea about electrical power, its transmission and three phase systems.
- To have a working idea about DC Motor and Generators.
- To have working ideas about Three phase induction motors (Cage motors and Slip-ring Motors), Transformers.

- To know about lead-acid storage batteries.
- To know about various electrical hazards and earthing requirements.

## Course Contents:

### Unit- I: Introduction to Electrical Power

- Energy Sources – Conventional and non-conventional.
- Generation, Transmission and Distribution of Electrical Power (Only fundamental)
- **Three phase supply**: star and delta circuit, Line and phase current and voltage relation, expression of three phase power, simple problems.

### Unit-II: D.C. Machines

- **DC Generators**: Construction - main parts, materials they are made of, function of the parts.
- Field and armature connection diagrams and classification of the generators, on the basis of these connections.
- Deduction of emf equation and simple problems on DC Generators.
- Application of D.C. Generators.
- **DC Motors**: Principle of operation and classification. Back emf; deduction of expression for torque, simple problems.
- Speed control of shunt and series motor-armature resistance control and field control only; reversal of direction of rotation.
- Application of D.C. motors.

### Unit-III: A.C. Machines

#### *Transformers:*

- Construction & principle of operation of single-phase transformers.
- E.M.F. equation and deduction of the relations -  $N_1/N_2 = E_1/E_2 = I_1/I_2$
- Various losses (only names and basic concepts); Simple numerical problems.
- Connections of 3 phase transformers:
  - Star / Star
  - Delta/Delta
  - Star/ Delta
  - Delta /Star (connections only)
- Applications of Transformers.

#### *Three Phase Induction Motors:*

- Construction, principle of operation and classification (squirrel cage, slip ring motors)
- Definition and relationship of syn. Speed, actual speed, slip and frequency of rotor current, solve simple problems.
- **Starters**: DOL and Star/delta for cage motors; Rotor- Rheostat starter for slip ring motor

- Reversal of direction of rotation & Industrial Application of both squirrel cage and slip ring induction motor.

#### **Unit-IV: Storage Batteries (Lead Acid cell)**

- Construction - different parts, materials they are made of and their functions.
- Charging - different methods, conditions of full charge.
- Defects, maintenance & uses.

#### **Unit-V: Electrical Hazards (Shock & Fire) and Earthing**

- Electric Shock, Effects of Electrical Current on the human body, Precautions to be taken, Treatment for electric shock.
- Fire – Different types of Fire, their causes, Fire Extinguishers and their applications.
- Earthing – Necessity of earthing, types of earthing, Earth resistance values as per latest CEA Regulations.

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

1. A text book of Electrical Technology Vol-I & II, B.L. Thereja
2. Basic Electrical Engineering, J.B. Gupta
3. Installation, Commissioning & Maintenance of Electrical Equipments, Tarlok Singh
4. A Study of CEA Regulations, 2010 by L.C.Kaku

#### **Course outcomes:**

After completing this course, student will be able to:

- Understand the requirement of electrical energy in mines.
- Apply the acquired knowledge of the DC Generators and DC Motors in mines, particularly during their maintenance operations.
- Apply the acquired knowledge of the AC machines including Transformers in mines, particularly during their maintenance operations.
- Know how storage batteries work and are used in different fields.
- Understand about electrical hazards and take preventive measures.

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Course Code	:	MINPC 411
Course Title	:	Mine Ventilation Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	NIL
Course Category	:	PC

**Course Objectives:**

To become conversant with different Instruments used and procedures adopted in underground mines for measuring different ventilation parameters.

**List of practicals to be performed:**

1.	Mason's dry and wet bulb hygrometer and Storrow's Whirling hygrometer.
2.	Measurement of air velocity using Vane Anemometer.
3.	Study and sketch of PITOT TUBE and INCLINED MANOMETER
4.	Study and sketch of air crossing, regulators, ventilation doors and air locks.
5.	Study and sketch of different types of mine fans with reversal arrangements.
6.	Study of conventions for preparation of mine plan and section.
7.	Study of simple mine plans showing a ventilation system of mine.
8.	Calculation of air quantity flowing in a mine gallery.

**Suggested learning resources:**

1. D. J. Deshmukh, Elements of Mining Technology – Vol 2
2. Mishra, G. B., Mine Environment and Ventilation, Oxford University Press, Sixth Impression, 1994
3. Banerjee, S. P., Mine Ventilation, Lovely Prakashan, 1st Edition, 2003
4. CMR-2017 and DGMS circulars

**Course outcomes:**

After completing this course, student will be able to:

- Determine relative humidity of air.
- Measure air velocity using a vane anemometer.



- Use a pitot tube and inclined manometer to measure air pressure.
- Understand the utilities of air crossing, regulator, ventilation door and air lock.
- Understand the operating procedure of different types of mine fans used for ventilation in mines.
- Study (read) a ventilation plan as well as prepare a ventilation plan.
- Conduct quantity of air surveying.

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Course Code	:	MINPC 412
Course Title	:	Mine Survey- I Lab
Number of Credits	:	2 (L : 0, T : 0, P : 4)
Prerequisites	:	Geometry, Engineering Graphics and Mine Survey – I theory
Course Category	:	PC

**Course Objectives:**

Following are the objectives of this course:

- To understand types of surveying works required.
- To know the type of method and equipment to be used for different surveys.
- To know the use and operational details of various surveying equipment.

**List of practicals to be performed:**

1	Measure distance between two survey stations using chain, tape and ranging rods when two stations are inter visible; Taking offset by chaining.
2	Determine area of open fields using chain and cross staff survey.
3	Undertake simple levelling using Dumpy level/ Tilting level or Automatic level.
4	Undertake differential levelling and determine Reduced Levels by Height of Instrument method and Rise & Fall method using Dumpy level/ Auto level and levelling staff.
5	Undertake fly levelling with double check using Dumpy level/ Auto level and levelling staff.
6	Undertake survey project with Levelling instrument for Profile levelling and cross-sectioning of a road.
7	Plot the L-section with minimum 3- cross sections on A1 size imperial sheet for data collected in the survey project mentioned at Practical No. 6.

8	Use Transit Theodolite to measure Horizontal and Vertical angle by Direct Method
9	Plot the traverse on A1 size imperial drawing sheet for the collected data in the survey project mentioned at Practical No. 8.
10	Undertake survey project for plotting contour map for a given area by method of gridding.
11	Plot the contours for data collected in the survey project mentioned at Practical No. 10.

### Course outcomes:

After completing this course, student will be able to:

- Select the type of survey required for a given situation.
- Compute area of open field using chain, tape and cross staff.
- Use levelling instruments to determine reduced level to prepare contour maps.
- Conduct traversing in the field by the use of Theodolite and prepare maps.

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Course Code	:	MINEPC 413
Course Title	:	Strata Control Lab
Number of Credits	:	2 (L: 0, T: 0, P: 2)
Prerequisites	:	Basic knowledge in Mathematics, Physics, Chemistry & Engineering Graphics
Course Category	:	PC

### Course Objectives:

To become conversant with the construction of different types of supports used in belowground mines and operational aspects of these supports including the strata monitoring instruments.

### List of practicals to be performed:

Sl. No	Name of the practical to be performed
1	Study and sketch of of Roof Bolts - different types, areas of operation
2	Study and sketch of Safari Supports
3	Study and sketch of Roof Stitching, Steel Arch Support & Wire Mesh
4	Study and sketch of Power Support

5	Study and sketch of prop, cog, chock, bar & cross bar support
6	Study and sketch of hydraulic prop and friction prop
7	Study and sketch of side supports used in belowground mine
8	Study and sketch of different strata monitoring instruments

**Suggested learning resources:**

1. Deshmukh D. J. (2010), Elements of Mining Technology, Vol.1 (8th Edition). Denett and Company, Nagpur.
2. Singh R D (1997) Principles and Practices of Modern Coal Mining. New AgePublisher, New Delhi.
3. Rock Mechanics, by Richard E. Goodman
4. Rock Mechanics and Strata Control, by B.S.Varma
5. Rock Mechanics & Ground Control, by D.Biswas, Lovely Prakashan, Dhanbad.
6. Gorai A.K (2018) A Complete Guide for Mining Engineers, Lovely Prakashan , Dhanbad
7. Miner's Handbook by Ali Murtoja Shaikh.

**Course outcomes:**

After completing this course, student will able –

- To support roofs and sides in an underground mine.
- Understand the supporting system by powered supports in longwall workings.
- To understand the use of the strata monitoring instruments and take necessary precautions against the movement of the roof.

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Course Code	:	MINPC 414
Course Title	:	Electro- technology in Mining Lab.
Number of Credits	:	1 (L : 0, T : 0, P : 2)
Prerequisites	:	Basic knowledge in Physics, Chemistry
Course Category	:	PC

**Course Objectives:**

To become conversant with the construction and working principles of some widely used electrical apparatus in mines and safe operational aspects of these apparatus.

**List of practicals to be performed:**

1	Study of Megger and its applications.
2	Study of constructional features of a D.C. machine.
3	Study of constructional features of 3-phase induction motor.
4	Study of star/delta starter for 3-phase induction motor.
5	Study of direct on-line starter for 3-phase induction motor.
6	Study of constructional features of 3- phase transformers.
7	Study of CEA regulations that applies when Electricity is used in Mines (More focus on regulations relating to: voltage and current limits, earthing requirements, cables, ground clearance, switchgear, transformer, portable electrical equipment, sundry safety precautions and precautions where gas may exist).
8	Study of 3-phase AC supply system.
9	Study of lead-acid storage batteries.

**Suggested learning resources:**

1. A text book of Electrical Technology Vol-I & II , B.L. Thereja
2. Basic Electrical Engineering, .J.B.Gupta .
3. Installation, Commissioning & Maintenance of Electrical Equipments, Tarlok Singh
4. A Study of CEA Regulations, 2010 by L.C.Kaku

**Course outcomes:**

After completing this course, student will be able to:

- Understand the requirement of electrical energy in mines.
- Apply the acquired knowledge of the DC Generators and DC Motors in mines, particularly during their maintenance operations.
- Apply the acquired knowledge of the AC machines including Transformers in mines, particularly during their maintenance operations.
- Know how storage batteries work and are used in different fields.
- Understand about electrical hazards and take preventive measures.

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Course Code	:	MINPE 421
Course Title	:	Special Underground Mining
Number of Credits	:	2 (L : 2, T : 0, P : 0)
Prerequisites	:	Basic knowledge in Mathematics, Physics, Chemistry & Engineering Graphics
Course Category	:	PE

#### TOPIC WISE DISTRIBUTION OF THE COURSE:

UNIT	TOPIC	LECTURE PERIODS	TUTORIAL PERIODS
<b>I</b>	<b>Bord &amp; Pillar method using Continuous Miner</b>	<b>10</b>	<b>0</b>
<b>II</b>	<b>Mining of thick and thin seams</b>	<b>6</b>	<b>0</b>
<b>III</b>	<b>Hydraulic Mining of Coal</b>	<b>4</b>	<b>0</b>
<b>IV</b>	<b>Underground Coal Gasification</b>	<b>6</b>	<b>0</b>
<b>V</b>	<b>Highwall Mining</b>	<b>4</b>	<b>0</b>

#### Course Objectives:

To learn various special methods practised in underground mines.

#### Course Content:

##### Unit- I Bord & Pillar method using Continuous Miner

- Formation and extraction of pillars by Bord & Pillar method using Continuous Miner - Split and Fender method, Wongawilli method, Rib pillar extraction method
- Statutory provisions regarding formation and extraction of pillars by Bord & Pillar method using Continuous Miner
- Machineries used in Bord and Pillar working using Continuous Miner– Continuous Miner, Shuttle Car/ Ram Car, Rock Bolters (Twin/ Quad Bolter etc.), Feeder Breaker, LHD – operational aspects only
- Simple layouts of formation and extraction in Bord and Pillar method using Continuous Miner
- Case studies of Bord & Pillar mining method using Continuous Miner in India

## **Unit- II Mining of thick and thin seams**

- Problems of mining thick seams; Longwall based multi-slice methods: Inclined slicing, horizontal slicing and cross-slicing in ascending and descending sequence
- Under winning methods: sub-level caving, integral caving
- Longwall Top Coal Caving
- Blasting Gallery Method
- Problems in Mining thin seams
- Equipment and methods for thin seam extraction.

## **Unit- III Hydraulic Mining of Coal**

- Conditions suitable for hydraulic Mining of Coal
- Hydraulic Mining Operation
- Layout of workings for hydraulic mining of moderately thick seams.

## **Unit- IV Underground Coal Gasification (UCG)**

- Conditions suitable for Underground Coal Gasification
- Basic principle and technology of underground coal gasification
- Advantage and disadvantage of UCG
- Scope of application of UCG in Indian conditions.

## **Unit- V Highwall Mining**

- Introduction, Applicability and Method
- Scope of application of Highwall Mining in Indian conditions

## **Suggested learning resources:**

1. Singh, T. N., Underground winning of Coal, Oxford and IBH, New Delhi, 1992
2. Statham, I. C. F., Coal Mining Practice, Caxton eastern agencies, Calcutta, Reprint, 1964
3. Das, S. K., Modern Coal Mining Technology, Lovely Prakashan, Dhanbad, 1992
4. Singh, R. D., Principles & Practices of Modern Coal Mining, New Age International, New Delhi, 1997
5. Peng, S. S. and Chiang, H. S., Longwall Mining, John Willey and Sons, New York, 1992

## **Course outcomes:**

After completing this course, student will be able to:

- Supervise Bord & Pillar method using Continuous Miner in a belowground mine.

- Understand mining methods under difficult geo-mining conditions and supervise mining in thick seam and thin seam.
- Supervise hydraulic mining method.
- Have fundamental ideas about underground coal gasification.
- Understand the basics of the highwall mining method.

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Course Code	:	MINPE 422
Course Title	:	Surface Mining-II
Number of Credits	:	2 (L : 2, T : 0, P : 0)
Prerequisites	:	Basic knowledge of Surface Mining-I
Course Category	:	PE

**TOPIC WISE DISTRIBUTION OF THE COURSE:**

UNIT	TOPIC	LECTURE PERIODS	TUTORIAL PERIODS
<b>I</b>	<b>Planning and Preparation of Surface Mines</b>	<b>4</b>	<b>0</b>
<b>II</b>	<b>Discontinuous/Cyclic Methods of Excavation and Transport</b>	<b>8</b>	<b>0</b>
<b>III</b>	<b>Continuous Methods of Excavation and Transport</b>	<b>6</b>	<b>0</b>
<b>IV</b>	<b>Semi-Continuous Methods of Excavation and Transport</b>	<b>4</b>	<b>0</b>
<b>V</b>	<b>Method of Work for Different type of deposits (Layout only)</b>	<b>4</b>	<b>0</b>
<b>VI</b>	<b>Special Methods</b>	<b>4</b>	<b>0</b>

**Course Objectives:**

Following are the objectives of this course:

- To understand the design aspect of a surface mine.
- To know about different discontinuous/ cyclic methods of surface mining.
- To know about different continuous methods of surface mining.
- To know about different combinations of cyclic & methods of surface mining.
- To select suitable methods of working for various types of deposits.
- To understand different special methods of surface excavation.

**Course Content:**

**Unit- I Planning and Preparation of Surface Mines**

- Deposits amenable to extraction by surface mining.
- Preliminary evaluation of surface mining prospect.
- Ripper - applicability and limitations; Basic concept of rippability - method and cycle of operation, estimation of output
- Blast hole drilling - estimation of number of drills required for a given mine production.

**Unit- II Discontinuous/Cyclic Methods of Excavation and Transport**

- Shovel-dumper operation - fleet size estimation, application of shovel-dumper combination in various types of deposits;
- Dragline operation - different modes of operation, reach calculation, cycle time and productivity calculation; Calculation of bucket capacity;
- Scrapers - applicability and limitations, various types, method and cycle of operation
- Dozers - types and classification, types of blade (basic idea only)
- Front-end-loaders - applicability and limitations, method and cycle of operation-concept, minimum tipping- load, selection of bucket capacity.

**Unit- III Continuous Methods of Excavation and Transport:**

- Bucket wheel excavators - half and full block methods and their corresponding merits and demerits, productivity calculation;
- Continuous surface miners - types, classification, classification of operational methods (basic idea only)
- Conveyors -shiftable and high angle conveyors, mode of operation, merits, demerits, applicability and limitations.

**Unit- IV Semi-Continuous Methods of Excavation and Transport:**

- Continuous excavation and partly/fully cyclic transport system - applicability and limitations
- Different in-pit crushing and conveying methods and their respective applicability and limitations.



### **Unit- V Method of Work for Different type of deposits (Layout only)**

- Method of work for subsurface deposits (bedded, massive and vein type)
- Method of work for hilly deposits (bedded, massive and cap type)

### **Unit- VI Special Methods**

- Trench Method – applicability, principle of operation
- Highwall Method - applicability, principle of operation
- Dredging Method - applicability, principle of operation
- Hydraulic Method – applicability, principle of operation

### **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 & Relevant DGMS Circulars.

### **Course outcomes:**

After completing this course, student will be able to:

- Understand the planning & be part of preparations to open a surface mine.
- Take the decision to deploy various machineries in different mining conditions.
- Select different methods of working for different types of deposits.
- Carry out mining operations in different types of deposits.
- Acquire knowledge about special types of surface mining operations.

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Course Code	:	MINPR 451
Course Title	:	Minor Project
Number of Credits	:	2 (L : 0, T : 0, P : 4)
Prerequisites	:	Knowledge of all courses that have been taught till date
Course Category	:	PR

**Course Objectives:**

Following are the objectives of this course:

- To understand the inter- relationship among different courses learnt in the Diploma Program till date.
- To work in a team by preparing a model/ preparing a research work and making a presentation/ facing viva- voce.
- To give students a platform to learn the basic idea of paper writing.

**Procedures to be observed:**

Students will select a topic in engineering from the courses in the academic curriculum. They will prepare any model on the topic after formation of a team that is guided by the concerned guide or write a report on a topic/ any specific method of working/ any machinery that was observed during the Internship-I, prepare a presentation and deliver it and/or facing viva- voce.

**Course outcomes:**

After completing this course, student will be able to:

- To work as a team member.
- Interrelate different aspects of engineering and present in a model.
- Write and present a technical research paper.

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