



SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology

Syllabus

Course: Diploma
Semester: III

Branch: Mining and Mine Surveying
Academic Session: 2024-25

SUBJECT – INTRODUCTION TO MINING

SUBJECT CODE – DMI031

Course Objective

The objective of this course is to provide students with a foundational understanding of mining principles, techniques, and equipment, with a focus on both coal and non-coal mineral resources. By exploring different methods of resource extraction, students will gain a comprehensive overview of mining operations, from prospecting to transportation.

Unit 1: Mining Terminologies & Mineral Resources

Mining Terminology/Definitions, Mineral Resource of India, Mineral and energy resources of world, Mineral resources of Madhya Pradesh & Chhattisgarh, Minerals - their occurrences, production trend and uses.

Unit 2: Exploration and Prospecting

Prospecting & Exploration- Reconnaissance, Principles and methods, Trenching & Pitting.

Boring- Principles of boring, surface layout, Chief uses of boreholes, percussive method by rigid rods, rope drilling, boring tools used in percussive method.

Rotary Boring- various systems, different types of bits, water flushing & drilling mud, mud flushing, core recovery, single tube & double tube core barrel, wire line core barrel, diamond drilling. Borehole logging.

Trouble during boring operations- caving of wall of borehole, loss of water, deviation of bore hole, survey of bore holes, loss of bit, rod damage or disengagement inside the hole, excessive wear of bit, breakage or loss of diamond

Unit 3: Introduction to Mining Methods

Elementary ideas about Mining, Underground, Opencast/Surface Mining for Coal (and Lignite) and Non-Coal Minerals, Comparison of underground and surface mining, Coal Bed Methane (CBM), Placer Mining, Sea Bed Mining etc.

Unit 4: Access to Mineral Deposits

Shaft Access in Underground Mining, Adit Access and Its Applications in Mining, Tunnel Access Methods for Mineral Deposits, Incline Access in Underground Mining, Bench Design and Access in Open-Pit Mining.

Unit 5: Haulage and Transportation

Basic haulage equipment and their application, Basic idea about Transportation equipment and their application/use in mines.



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Course Outcomes

- CO1** Define key mining terms and describe mineral resources, their occurrences, production trends, and uses in India, MP, Chhattisgarh, and globally.
- CO2** Explain prospecting methods, boring techniques, rotary boring systems, and address challenges during boring operations.
- CO3** Compare underground and surface mining methods for coal and non-coal minerals, including advanced techniques like CBM and seabed mining.
- CO4** Evaluate different access methods to mineral deposits, including shaft, adit, tunnel, incline, and open-pit bench design.
- CO5** Identify and explain the function and application of loading and transportation equipment in mining operations.

Textbooks:

1. Dr. G.K.Pradhan, Explosives & Blasting Techniques, Mintech Publications, Bhubaneswar
2. D.J.Deshmukh, Elements of Mining Technology, Vol. I, Denett & Co., Nagpur
3. Dr. T.N.Singh, Surface Mining, Lovely Prakashan, Dhanbad
4. Dr. S.K.Das, A Handbook on Surface Mining Technology, Lovely Prakashan, Dhanbad

References:

1. Dr. G.K.Pradhan, Explosives & Blasting Techniques, Mintech Publications, Bhubaneswar
2. R.D. Singh, Principles & Practices of Modern Coal Mining, New Age International Pvt.Ltd., New Delhi.
3. Dr. S.M.Kole, Khuli Khan Ka Ayojan, CMPDIL Publication



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SUBJECT – MINE ENVIRONMENT AND VENTILATION

SUBJECT CODE – DMI032

Course Objective

The objective of this course is to provide students with the knowledge and skills necessary to ensure safe and efficient mine ventilation and environmental management. Students will learn to detect and manage mine gases, control air quality, and design ventilation and lighting systems to maintain safe working conditions for miners.

Unit 1: Mine Air

Different Gases / Damps found in mines, Definition of damps, their threshold limits, physiological effects, source of production and detection, Degree of gassiness of seam; Flame safety lamps, its principle, construction, safety features, and comparison. Detection of Methane by flame safety lamp; MSA Methanometer its principle of working, construction. Principle of other method of detection of methane; Oxymeter, Toximeter & multigas detector: their principle of working.

Unit 2: Mine Climate

Purpose and standards of ventilation, standards for minimum & maximum velocity of air for different locations; Pressure, ventilating pressure, watergauge; Temperature, sources of heat in mines; Moisture content of mine air, relative humidity, wet bulb temperature, measurement of relative humidity; Cooling power of mine air, determination of cooling power, methods of improving cooling power of mine air, effect of heat and humidity on miners

Unit 3: Natural Ventilation

Natural ventilation Pressure, geothermic gradient, Factors causing NVP, Effect of seasonal changes on direction of Natural ventilation, limitation of Natural ventilation; Motive column, calculation of natural ventilation pressure.

Unit 4: Artificial Ventilation

Different types of fans used in mines: centrifugal & axial flow, their principle of working, Exhaust & forcing type; Purposes of evasee & volute casing. Reversal of air current, and characteristics curves of fans. Fans in series and parallel; Comparison between axial flow & Centrifugal fan, exhaust & forcing Fan; Fan laws, Manometric efficiency, overall efficiency, theoretical depression produced by fan. 4.4 Numerical problems on fan laws.

Unit 5: Distribution and Coursing of Air in Mines

Laws of air flow in Mines, Atkinson's formula, splitting, advantages & disadvantages, Numerical problems on splitting, equivalent orifice. Numerical problems on equivalent orifice; Ventilation appliances, Auxiliary ventilation: Different methods, advantages & disadvantages, hazards associated with auxiliary ventilation, precautions required; Booster fan: purpose, location of booster fan. Numerical problems on booster fan; Ascensional and Descensional ventilation, Advantages and disadvantages.

Unit 6: Mine Illumination/Lighting

Lighting sources in mines, cap lamps, constructional feature of lamps; Underground lighting; Flameproof and intrinsically safe lighting; Lamp room layout, lamp room organization, care and maintenance of cap lamps; Lighting in opencast mines exactly as per statutory norms.



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Course Outcomes

- CO1** Identify and manage different mine gases and damp, including their threshold limits and physiological effects, and use flame safety lamps, Methanometers, and other detection methods to ensure safe mining conditions.
- CO2** Apply ventilation standards to control air velocity, pressure, temperature, and humidity in mines, and determine the cooling power of mine air and its effects on miner health.
- CO3** Understand natural ventilation principles, including pressure and geothermic gradients, and assess the effects of seasonal changes on ventilation, calculating natural ventilation pressure effectively.
- CO4** Select and operate different types of mine fans (centrifugal and axial flow), including their characteristics, efficiencies, and application in ventilation systems to manage airflow and maintain mine safety.
- CO5** Apply laws of air flow, including Atkinson's formula, for effective air distribution and ventilation in mines, and manage auxiliary ventilation methods, booster fan placement, and associated hazards.
- CO6** Design and implement effective mine lighting systems, including cap lamps and underground lighting, ensuring compliance with statutory norms for both underground and opencast mining operations.

Textbooks:

1. Dr. G.K.Pradhan, Explosives & Blasting Techniques, Mintech Publications, Bhubaneswar
2. D.J.Deshmukh, Elements of Mining Technology, Vol. I, Denett & Co., Nagpur
3. Dr. T.N.Singh, Surface Mining, Lovely Prakashan, Dhanbad
4. Dr. S.K.Das, A Handbook on Surface Mining Technology, Lovely Prakashan, Dhanbad
5. Elements of Mining Technology Vol II- D.J. Deshmukh
6. Mine Environment & Ventilation G.B. Mishra
7. Mine Ventilation Vol- I & II S. Ghatak



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SUBJECT – MINE SURVEYING

SUBJECT CODE – DMI033

Course Objective

The objective of this course is to provide students with the knowledge and skills necessary to ensure safe and efficient mine ventilation and environmental management. Students will learn to detect and manage mine gases, control air quality, and design ventilation and lighting systems to maintain safe working conditions for miners.

Unit 1: Levelling

Definitions of the terms used in Leveling. Concept of datum, Back sight, Foresight, stations, change point, height of instrument. Dumpy and tilling level Construction and temporary adjustments. Leveling staff, their types. Balancing of back sight and fore sight distances. Holding and Reading the staff, simple and differential leveling, and booking of readings, effect of curvature and refraction on leveling; Reduction of levels by Collimation system and by Rise & fall system. Arithmetic check, computation of missing readings.

Unit 2: Chain Survey

Linear Measurements; Types of chains; Tapes; Errors in chaining and corrections in linear measurements; Direct and indirect Ranging; Principles of chain surveying, Offsets, Limiting length of offsets; Booking field notes; Obstacles in chaining; Instruments for setting out right angles. electronic distance measurement, total station.

Unit 3: Contouring

Introduction and concept, definitions, purpose, Characteristic of Contour line, contour interval, factors affecting contour interval, Horizontal equivalent, Methods of Locating contours, Direct method, Indirect method, Interpolation of contours by estimation, arithmetical and by graphical method, Plotting of contour maps, Uses of contour map.

Unit 4: Subsidence Survey

Subsidence monitoring, data required for subsidence studies, parameters required during monitoring, layout of survey lines, survey stations, measurement techniques and Instrumentation, Measurement of displacement, slope and subsurface movement, frequency of subsidence measurement.

Unit 5: Dip, Strike and Boreholes Problems

Definition of borehole surveying; Purpose of borehole surveying; Definitions of dip, strike, true and apparent dip; Relation between true dip, app. Dip and angle between them; Numerical problems on dip, strike and borehole surveying.

Unit 5: Theodolite

Classification of theodolite; definitions and terms used in operating theodolite; Temporary adjustments of transit theodolite; Fundamental axes of theodolite; Measurement of horizontal angles: (i)General method, (ii) Repetition method, and (iii) Reiteration method; Measurement of vertical angle; Use of theodolite for Prolonging a straight line, lining in, and Lay-off.



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Course Outcomes

- CO1** Perform accurate leveling using Dumpy and Tiling levels, handle leveling staff, and apply reduction methods by Collimation and Rise & Fall systems to ensure precise height measurements in mining surveys.
- CO2** Conduct linear measurements using chains and tapes, apply corrections for errors, perform direct and indirect ranging, and utilize electronic distance measurement and total stations for accurate chain surveying.
- CO3** Create and interpret contour maps by applying methods for locating contours, adjusting contour intervals, and using interpolation techniques to represent terrain accurately for mining planning and operations.
- CO4** Monitor subsidence by collecting and analyzing data, setting up survey lines and stations, and measuring displacements and movements to assess and manage subsidence impacts on mining operations.
- CO5** Understand and apply concepts of dip, strike, and borehole surveying to solve related numerical problems, ensuring accurate geological assessments for effective mine planning and management.
- CO6** Operate and adjust various types of theodolites, measure horizontal and vertical angles, and use theodolites for tasks such as prolonging straight lines and aligning, enhancing precision in mine surveys.

Textbooks:

1. Surveying and leveling Vol. I & II - T. P. Kanetkar & S. V. Kulkarni
2. Surveying & Levelling - B.C. Punmia
3. Mine Surveying and levelling Vol I & II- S.Ghatak
4. Surveying & Levellinsg - Amarjit Aggarwal



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SUBJECT – APPLIED GEOLOGY

SUBJECT CODE – DMI034

Course Objective

The objective of this course is to provide students with a foundational understanding of geological concepts and their application to mining exploration and operations. Students will learn about the Earth's structure, geological processes, and rock and mineral classification, which are essential for assessing and managing mineral deposits.

Unit 1: General Geology

Scope of geology; Origin of Earth- various hypotheses; Age of earth - Various methods of age determinations, radioactive methods and their advantages; Interior of Earth crust, mantle and core; Continental drift Isostasy.

Unit 2: Physical Geology

Erosion & Weathering – Erosion, Transport and Deposition Vent facts, Pedestal rocks, sand dunes, and loess. Weathering: Physical Weathering and chemical Weathering. Exfoliation and spheroidal weathering; River & Wind Erosion – Erosion, transport and deposition, waterfalls, meanders, oxbow lakes, alluvial fans, flood plains, delta. Work of Wind: Erosion, Transport and Deposition Vent facts, Pedestal rocks, sand dunes, and loess; Earthquake – Seismographs, Earthquake waves, Classification of earthquakes, Elastic rebound theory, Richter scale of earthquake intensity, Distribution of Earthquakes; Volcano – Types of volcanoes, volcanic products volcanic cones, Distribution of volcanoes.

Unit 3: Mineralogy

Definition, Physical properties of minerals, Identification of common minerals: Orthoclase, Plagioclase, Augite, Hornblende, Biotite, Muscovite, Olivine, Quartz, Asbestos, Calcite, dolomite, corundum, Gypsum, and Talc.

Unit 4: Petrology

Rock cycle and characteristics of various rock types: Igneous Rocks – acid and basic rocks; Texture of Igneous rocks; Classification; Tabular classification of Igneous bodies – batholiths, laccoliths, sill and dyke lava flows; Common Igneous rock; Structure classification, occurrence & uses. Sedimentary Rocks – Definition, Classification: mechanically, organically, and chemically formed rocks; Sedimentary structures: stratification, lamination graded bedding, current bedding, and ripple marks; Common sedimentary rocks. Metamorphic Rocks – Definition; Agents of metamorphism – Heat, uniform pressure, directed pressure, chemically active fluids and gases; Structures and textures of metamorphic rocks – slaty, schistose, gneissose, and granulose; Common metamorphic rocks.

Unit 5: Structural Geology

Strike & Dip; Apparent Dip; True Dip; Folds- Elements of folds, anticline and syncline, limbs, axial plane, axis of fold. Types of fold; Faults – Fault terminology, fault-plane, hade, dip and strike, throw, heave, slip, hanging wall and foot-wall, classification of faults; Unconformity – Definition, types – angular unconformity, disconformity, nonconformity; Joints and Cleavages – Classification of Joints, Outlier and Inlier.

Unit 6: Fossils

Fossils: Definition, mode of occurrence, uses of fossils.



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Course Outcomes

- CO1** Understand the branches and sub-branches of geology, the scope of geology, and the origin and age of the Earth. Apply knowledge of Earth's interior and concepts like continental drift and isostasy to mining exploration and assessment.
- CO2** Analyze erosion, weathering, and landforms caused by rivers and wind. Use knowledge of earthquakes and volcanic activity to assess and mitigate geological hazards in mining areas.
- CO3** Identify and classify minerals based on physical properties. Apply this understanding to explore and evaluate mineral deposits relevant to mining operations.
- CO4** Classify and interpret igneous, sedimentary, and metamorphic rocks. Use rock cycle concepts and classification to determine rock types and their suitability for various mining applications.
- CO5** Analyze geological structures including folds, faults, and joints. Apply knowledge of strike, dip, and structural features to assess ore bodies and plan mining operations effectively.
- CO6** Understand the occurrence and uses of fossils. Apply fossil knowledge to geological dating and stratigraphic correlation in mining exploration.

Textbooks:

1. Principles of Engineering Geology – K.M.Bangar
2. A text book of Geology – P.K. Mukherjee
3. Engineering and General Geology – Parbin Singh



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SUBJECT – BASIC ELECTRICAL AND ELECTRONICS

SUBJECT CODE – DMI035

Course Objective

The objective of this course is to provide students with a strong foundation in electrical and electronics concepts, with an emphasis on their application in mining operations. Students will gain an understanding of electrical systems, machines, and circuits, enabling them to optimize the performance and safety of mining equipment and infrastructure.

Unit 1: Fundamentals of Electrical Engineering

Concept of electric current; potential and potential difference (Voltage); Sources of D.C. and A.C. Electric energy; Methods of voltage generation and standard voltages used in generation transmission and distribution; Electrical power, energy and their units.

Unit 2: D.C. Circuits

Ohm's Law; Concept of resistance, conductance, resistivity, conductivity and their units; Effect of temperature on resistance; Temperature coefficient of resistance; Connections of resistances: Series, Parallel connections and their combinations; Kirchoff's Voltage Law and its numerical, Kirchoff's Current Law and its numerical.

Unit 3: A.C. Circuits

Generation of single phase and three phase sinusoidal voltage; Vector representation; Concept of cycle, frequency, time period, amplitude, phase and phase difference; Define instantaneous value, average value, RMS value and peak value of sinusoidal electrical quantities; Derive relationship between them; Form factor and peak factor; Current voltage and power in pure resistive, inductive and capacitive circuit; Concept of reactance, impedance and power factor in R.L., R. C. and RLC Series circuit; Causes and effect of poor power factor; Methods of improving power factor; Three phase AC supply – three phase three wire and three phase four wire system; Relationship between VL and VPH, IL and IPH and three phase power in star and delta connected load.

Unit 4: D.C. Machines

Review of concept of Electromagnetism and related laws (Faraday's Law, Lenz's Law, Cork Screw Rule, Fleming's Left Hand & Right Hand Rule); Construction of D.C. Machines, its main parts and their functions; Classification of D.C. Machines; D.C. Generator: Principle, EMF equation (Derivation and simple numerical), Types of D.C. Generator, Applications of DC generator; D.C. Motor: Working Principle of DC motor, Types of DC motor, significance of back EMF, Torque equation, Characteristics of D.C. Series and Shunt Motor, Applications of D.C. Motor, D.C. Motor starter – Three point starter, Efficiency.

Unit 5: A.C. Machines

Single Phase Transformer: Construction, working principle; EMF Equation (Derivation with simple numerical), Turn ratio, Step up and Step down transformers and their application, losses, efficiency and regulation; Three Phase Induction Motor: Construction, types, principle of operation, Concept of Slip and its numerical, Applications, Starters: DOL and Star Delta; Single Phase Induction Motor: Methods of making a single phase motor self-start. Types of single-phase induction motor – capacitor start, capacitor run and shaded pole and their applications; Synchronous Machines: Synchronous motor – construction, principle of operation, comparison with three phase induction motor, Synchronous generator (alternator) – Construction, principle of operation, speed and frequency, synchronous speed.



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Course Outcomes

- CO1** Understand the basic concepts of electric current, potential, and potential difference (voltage). Apply knowledge of D.C. and A.C. sources, voltage generation methods, and standard voltages in the generation, transmission, and distribution of electrical energy to mining operations.
- CO2** Analyze D.C. circuits using Ohm's Law and Kirchoff's Laws. Apply concepts of resistance, conductance, and resistivity to design and troubleshoot electrical systems in mining operations, including series and parallel circuits.
- CO3** Understand the generation and characteristics of single-phase and three-phase A.C. systems. Apply knowledge of sinusoidal voltage, current, and power to optimize A.C. circuit performance in mining equipment, including methods to improve power factor and handle three-phase systems.
- CO4** Identify the construction, operation, and types of D.C. machines. Apply principles of D.C. generators and motors, including their EMF equations and torque equations, to mining applications. Understand the importance of back EMF and efficient operation of D.C. motors in mining equipment.
- CO5** Analyze single-phase transformers, their construction, working principle, and applications in mining operations. Understand the operation of three-phase induction motors, including slip and starters. Apply knowledge of single-phase induction motors and synchronous machines to various mining machinery.

Textbooks:

1. Fundamental of Electrical Engineering and Electronics – B.L. Thareja , S. CHAND Publication
2. Basic Electrical Engineering – V.K. Mehta, S. CHAND Publication
3. Principles of Electronics – V.K. Mehta, S. CHAND Publication
4. Basic Electrical Engineering – V. N. Mittle, TMH
5. Electrical Machines Vol I & II – S.K.Bhattacharya, TTTI, Chandigarh
6. A Course book in Electrical & Electronic Measurement and Instrumentation, A.K. Sawhney.
7. Principles of Electrical Engg. and Electronics – V.K. Mehta, S. CHAND Publication
8. Electrical Technology – S.L.Uppal, Khanna Publication
9. Electrical Measurement – J.B. Gupta, Dhanpat Rai & Sons



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SUBJECT – MINE ENVIRONMENT AND VENTILATION LAB
SUBJECT CODE – DMI032P

- S. No.** **List of Experiments** *(At least Ten experiments are to be performed by each student)*
- 1 Demonstration of co-detector and measurement of carbon monoxide using Co-detector.
 - 2 Demonstration of MSA Methanometer and measurement of methane using Methanometer.
 - 3 Dismantling & assembling of different types of Flame safety lamps.
 - 4 Detection of Methane using flame safety lamp.
 - 5 Demonstration of whirling hygrometer and determination of relative humidity using whirling hygrometer.
 - 6 Demonstration of Kata thermometer and determination of cooling power by Kata thermometer.
 - 7 Demonstration of water gauge and measurement of fan water gauge.
 - 8 Demonstration of Reversal arrangement of centrifugal mine fan.
 - 9 Demonstration of Axial flow fan.
 - 10 Demonstration of various ventilation devices.
 - 11 Demonstration of vane Anemometer and determination of quantity by Anemometer.
 - 12 Demonstration of velometer and measurement of air velocity by velometer.
 - 13 Demonstration of Inclined manometer and pitot static tube and determination of velocity pressure.
 - 14 Demonstration of Gas Testing chamber.



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SUBJECT – MINE SURVEYING LAB

SUBJECT CODE – DMI033P

S. No.

List of Experiments

- 1 Demonstration of Dumpy level.
- 2 Carrying out, Temporary adjustments of dumpy level and conduct simple levelling, recording readings in levelling book and apply arithmetic check.
- 3 Differential levelling with Dumpy level- recording in level book, reduction of levels by both methods (H.I & Rise & Fall method) apply arithmetic check.
- 4 Fly levelling for carrying benchmark at a station at least 300 m away by Dumpy level.
- 5 Demonstration of auto level
- 6 Levelling by using auto level
- 7 Demonstration of theodolite, reading the vernier.
- 8 Measurement of horizontal angle by ordinary method.
- 9 Temporary adjustments of theodolite & measurement of horizontal angle by repetition method.
- 10 Measurement of horizontal angle by reiteration method.



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SUBJECT – APPLIED GEOLOGY LAB

SUBJECT CODE – DMI034P

S. No.

List of Experiments

- 1** Identification of Minerals in sets. Colour Form Cleavage Fracture Luster Streak Mohr's scale of hardness.
- 2** Identification of Minerals on the basis of physical properties in hand specimens. Asbestos, Augite, Biotite, Calcite, Corundum, Dolomite, Gypsum, Hornblende, Muscovite, Kaolinite, Orthoclase, Plagioclase, Quartz, Talc.
- 3** Identification of Igneous Rocks in Hand specimen. - Granite, Rhyolite, Syenite, Gabbro, Basalt, Trachyte.
- 4** Identification of sedimentary rocks in Hand specimen. - Conglomerate, Sandstone, Shale, Limestone.
- 5** Identification of Metamorphic rocks in Hand specimen. - Slate, Schist, Gneiss, Quartzite, Marble.



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SUBJECT – BASIC ELECTRICAL AND ELECTRONICS LAB

SUBJECT CODE – DMI035P

S. No.

List of Experiments

- 1 Verification of Kirchoff's Law
- 2 To Measure Voltage Current and power in single phase AC circuit.
- 3 To calculate Impedance, power and power factor by measuring voltage across each element and current to the circuit for a given RLC series circuit.
- 4 Study of different parts of DC machine.
- 5 Study of three-point starter for DC motor.
- 6 To determine transformation ratio of a given single phase transformer.
- 7 Study and operation of DOL and Star Delta Starter.
- 8 To measure slip for a given three phase induction motor.
- 9 To measure insulation resistance by Megger.
- 10 To measure earth resistance by earth tester.