

**Department of Mining Engineering,  
Faculty of Engineering & Technology,  
AKS, University, Satna, M.P.**



**Study and Evaluation Scheme**  
**of**  
**DIPLOMA**  
**(Mining and Mine Surveying Engineering)**

(Applicable w.e.f Academic Session July 2022 till revised)

**Department of Mining Engineering,  
Faculty of Engineering & Technology,  
Diploma (Mining & Mine Surveying Engg.)  
(Session-2022)**

<b>Teaching and Examination Scheme Diploma-III</b>						
S. N.	Subject Code	Subject Name	L	T	P	Credit
1	10MI301	Surface Mining	04			04
2	10GE302	Mining Geology-I	04			04
3	10MI303	Mine Development- Drilling & Blasting	04			04
4	10MI304	Mine Environment - 1	04			04
5	10CE305	Mine Surveying – I	04			04
6	10MI308	Mining Legislation and General Safety				04
7	10GE351	Mining Geology-I - LAB			02	01
8	10MI352	Mine Development- Drilling & Blasting- LAB			02	01
9	10MI353	Mine Surveying - I - LAB			02	01
10	10MI354	Mine Environment 1 -LAB			02	01
			20		08	28
<b>Total Credit=28</b>						

<b>Teaching and Examination Scheme Diploma-IV</b>						
S. N.	Subject Code	Subject Name	L	T	P	Credit
1	10MI401	Method of Work Coal	03	01		04
2	10EE402	Mine Electrical Engineering	03	01		04
3	10MI409	Mining Hazard & Safety	03	01		04
4	10MI404	Mine Environment-II	03	01		04
5	10GE405	Geology-II	03	01		04
6	10MI406	Advanced Mine Surveying-I	03	01		04
7	10MI451	Method of Work Coal LAB			02	01
8	10MI452	Mine Environment-II LAB			02	01
9	10GE453	Geology-II LAB			02	01
10	10MI454	Advanced Mine Surveying -LAB			02	01
11	10EE455	Mine Electrical Engineering -LAB			02	01
			18	06	10	29
<b>Total Credit=29</b>						
12	10MI454	Practical Training and Assessment	<b>During IV and V semester break for 45 days marks to be awarded in V Semester</b>			
<b>Total Credit=29</b>						

**Department of Mining Engineering,  
Faculty of Engineering & Technology,**

<b>Teaching and Examination Scheme Diploma-V</b>						
S. N.	Subject Code	Subject Name	L	T	P	Credit
1	10MI506	Mine Sampling Assaying Coal/ Mineral Processing	03	01		04
2	10MI502	Mining Machinery I	03	01		04
3	10GE504	Rock Mechanics & Strata Control	03	01		04
4	10MI507	Mine Hazard Safety and legislation	03	01		04
5	10MI551	Semester break Training Report submission				04
6	10MI555	Mine Hazard Safety and legislation LAB			02	01
7	10MI553	Mining Machinery (Lab)			02	01
8					02	01
9	10MI554	Mine Sampling Assaying Coal/ Mineral Processing LAB			02	01
10	10GE552	Rock Mechanics (Lab)	12	04	08	24
<b>Total Credit=24</b>						

**Diploma (Mining & Mine Surveying Engg.)  
(Session-2022)**

<b>Teaching and Examination Scheme Diploma-VI</b>						
S. N.	Subject Code	Subject Name	L	T	P	Credit
1	10MI604	Advanced Mine Surveying-II	03	01		04
2	<i>Elective (Choose any one)</i>					
	10MI602-A	Mine management and mine economics	03	01		04
	10MI602-B	Mine Electrical Engineering, Energy Resources and saving in mining				
3	10MI603	Mine Machinery-II	03	01		04
4	10MI601	Metal Mining	03	01		04
5	<i>Project Work (any one from A or B)</i>					08
	10MI651-A	Surveying/Mining ( Open Cast)				
	10MI651-B	Surveying / Mining(Under Ground )				
6	10MI652	Mine Machinery-II LAB			02	01
7	10MI654	Metal Mining (Lab)			02	01
8	10MI655	Advanced Mine Surveying II-LAB			02	01
<b>Total Credit=27</b>			12	04	06	27

**Diploma (Semester-III)  
Mining & Mine Surveying**

**SURFACE MINING**

**Unit I**

Different basic concepts about surface mining: Define the term surface mining - basic concepts, applicability, advantages and disadvantages; systems—classification, applicability, advantages and disadvantages. List the different norms of surface mining, Define the following terms related to surface mining with comprehensive sketches - Outcrop, overburden, face. Bench, floor of bench, depth of hole, spacing, burden. Toe, crest, back break. angle of repose. , stripping ratio, economic cut Off value, quarriable limit, Opening up of deposits: Box cut - Production benches, layout of benches formation, parameters and factors affecting their selection.

**Unit II**

Drilling and blasting techniques in surface mines - Classification of the drill holes., Applications of vertical and inclined drilling. Merits and demerits of vertical and inclined drilling . Different parameters connected to drilling of blast holes. Patterns of drill holes employed.

Theory of surface mine blasting, Explosives, Blast design. Bench blasting pattern, Delay blasting - Blasting tools - Charging of explosives - Problems in blasting, environmental problems due to blasting, - Safety in blasting - Controlled blasting techniques - Secondary Blasting.

**Unit III**

Different type of HEMM used in OCM Selection & Application. (shovel, hydraulic excavator, wheel loader, dumper, ripper, dozer, road grader Drag line, BWE, spreader Surface Miner, Highwall mining). Study of layout of Shovel-dumper combination and dragline system. In Pit Crushing & Conveying (IPCC) ,hydraulic rock breaker, splitter.

**Unit IV**

Slope stability(bench & dump), dump design, back filling Different types of slope failures', measures to be taken against slope failures, Instrument used in slope stability, Pumping & drainage system,

**Unit V**

Mine Illumination(lighting standard, measurement plan),Acid Mine Drainage - Necessity of EIA &Environment Management Plan - Essential features of EIA & EMP, environmental impact of surface mining

**Text Books**

1. A Handbook on Surface Mining Technology : Dr. Samir K Das, Sagardeep Prakashan, Kharagpur
2. Surface Mining : TN Singh, Lovely Prakashan, Dhanbad
3. Elements of Mining Technology, Vol. I. D. J Deshmukh Denett & Co., Nagpur
4. B. V. Gokhale, Blasthole chilling IQchnology. Multi Fields, Botnbay
5. Dr G. K. Pradhan. Explosives & Blasting Techniques. 4th Edition, 2020, an AKS University Initiative, Mintech Publications. Bhubaneswar, p. 572.
6. K. A. Pant, Anamika Publishers, (in Hindi)
7. DGMS Circulars

**Diploma (Semester-III)**  
**Mining & Mine Surveying**  
**GEOLOGY-I**

**Unit-I : General Geology**

Branches; Allied (ex. Geophysics, Geochemistry, etc) ; Scope of Geology; Origin of Earth-various hypothesis. Age of earth - Various methods of age determinations, radioactive methods and their advantages. Interior of Earth crust, mantle and core. Continental drift Isostasy.

**Volcano** - Types of volcanoes, volcanic products volcanic cones, Distribution of volcanoes.

**Earthquake** - Earthquake waves, Classification of earthquakes, Elastic rebound theory, Richter scale of earthquake intensity, Distribution of Earthquakes in India(seismic zone ). Seismographs

**Unit-II: Petrology**

Rock cycle and characteristics of various Rock types. Classification of Igneous Rocks ; acid and basic rocks, Plutonic, Hyp abyssal and Volcanic rocks. Texture of Igneous rocks.

Sedimentary Rocks - Definition, Classification; Mechanically formed, Organically formed and chemically formed rocks, Sedimentary Structures; Common sedimentary rocks-Conglomerate sandstone, Shale, coal, limestone and breccias.

Metamorphic Rocks - Definition; Agents of Metamorphism,. Structures and textures of metamorphic rocks. Common metamorphic rocks; slate Schist, Gneiss, Quartzite, and marble .

**Unit-III: Mineralogy**

Crystal System:- Isometric, Hexagonal, Tetragonal, Orthorhombic, Monoclinic, And Triclinic.

Minerals – definition, formation and occurrences. Identification – physical, chemical and optical. Classification of minerals.

Physical Properties of common rock forming Minerals Orthoclase, Biotite, Muscovite, Olivine, Quartz, Calcite, Gypsum, Talc.

**Unit-IV: : Physical Geology**

**Erosion & weathering** - Weathering: factor affecting weathering, Physical Weathering and chemical Weathering. Exfoliation and Spheroidal weathering.

**Work of River/stream** - 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

**Unit-V: Structural Geology**

Strike & Dip, Folds- Elements of Folds, anticline and syncline, limbs, axial plane, Axis of fold. Types of fold-symmetrical, Asymmetrical, Overturned, recumbent, Isoclinal, Plunging folds ,Anticlinorium, Synclinorium ,Open fold, close fold, Dome and Basin.

Faults- Fault Terminology, Fault-plane, Hade, Dip and strike, throw, Heave, Slip, Hanging wall and foot-wall. Classification of faults-normal and reverse faults, Dip fault, strike-fault and oblique-faults, High and low angle faults, parallel faults, step-faults, Graben, Horst, Radial faults, Peripheral faults.

Unconformity; Definition, Angular unconformity, Disconformity, Nonconformity.

Joints & its Classification; Strike Joints, dip Joints oblique Joints, bedding Joints, master Joints, sheet Joints and Columnar Joints. Outlier and Inlier.

## **PRACTICAL: MINING GEOLOGY-I**

1. Megascopic Study and Physical Identification of Rock forming Minerals by their physical properties.
  1. Megascopic Study and Physical Identification of Igneous Rock by their physical properties.
  2. Megascopic Study and Physical Identification of Sedimentary Rock by their physical properties.
  3. Megascopic Study and Physical Identification of Metamorphic Rock by their physical properties.
  4. Microscopic Study and Identification of Rock forming Minerals by their Optical properties
  5. Microscopic Study and Identification of Igneous Rock by their Optical properties
  6. Microscopic Study and Identification of Sedimentary Rock by their Optical properties.
  7. Microscopic Study and Identification of Metamorphic Rock by their Optical properties.
  8. Draw the outcrop, Dip Strike and profile Section on different kinds of geological structural maps.
  9. Study and Sketch of Geological Models showing different types of Faults, Folds and their relations to photography.

### **Text Books:**

1. Introduction to Geology : G.B.Mahapatra
2. A Text Book of Geology : P.K. Mukherjee
3. Engineering And General Geology : Parbin Singh
4. Physical And Engineering Geology : S.K. Garg
5. Practical Geology, by Dr. Harish Kapasya, Dr. Harish Kapasya, Himanshu Publications

## **Diploma (Semester-III)**

### **Mining & Mine Surveying**

#### **MINE DEVELOPMENT- DRILLING & BLASTING**

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

General concepts of Mine Development (entry to the deposit both shallow and deep seated) selection of mine entry & comparison between shaft, incline & adit

##### **Unit II**

Shaft Sinking -selection, sinking layout, sinking methods(marking of holes, drilling, blasting, mucking, lining), sinking cycle, special method of sinking, deepening. Drifting, Inclines & declines.

##### **Unit-III**

Drills & Drilling for underground mining (coal and non-coal): Types of drills, drilling accessories, drillability of rocks, managing drilling in production mines, dust control and safety during drilling etc.

##### **Unit-IV**

Explosives – for Underground coal & metal mining Definitions of explosives, constituents of explosives,. Classification of explosives (i) Low & High Explosives (ii) Permitted & Non permitted explosives. Detonators & Accessories- Different types of detonators, advantage of delay detonators. Exploders: Different types, construction and safety features of exploders. Common causes of accidents from explosives, Misfired shots, blown through & blown out shots, causes & Dangers, remedial measures required..

Blasting practices in Mines- Solid blasting: Blasting-off-solids,- advantages and disadvantages, precautions and restrictions, pattern of shot holes. Shot-firer tools Preparation of charge Procedure for firing Direct & Indirect consideration of factors - Calculation of explosive quantity, powder factor, detonator factor. Transportation & storage of explosive, Magazine layout, construction & safety features.- Handling of explosives

##### **Unit-V**

Rock Fragmentation - Mechanism of rock fragmentation, Factors affecting rock fragmentation, Techniques to improve rock fragmentation. Environmental impact of blasting in underground mines:, over break, fly rock, blast induced vibration. fumes etc. Ground vibration measurement & DGMS standards, Prediction & control measures to reduce/check - air blast, noise

#### **PRACTICAL: MINE DEVELOPMENT- DRILLING & BLASTING**

1. Sketch and describe mine inclines top lay out with direct haulage.
2. Sketch and describe about pit top layout.
3. Sketch & describe blasting pattern in shaft sinking
4. Sketch and describe the usual method of drivage of gallery in coal mine showing usual at Tenements of pumps, transport (direct rope haulage) and ventilation in dip faces.
5. Sketch and describe different type of exploder.
6. Describe with Sketch different type accessories of blasting such as safety fuse, detonating fuse, Nonel.
7. Sketch and describe burn cut , wedge cut & fan cut
8. Sketch and describe different type of electric detonator.
9. Blast vibration definitions

**Text Books :**

1. Blasthole drilling Technology, by B.V. Gokhale, Multi Fields, Bombay
3. Explosives & Blasting Techniques, Dr G. K. Pradhan, Mintech Publications, Bhubaneswar.
4. Explosive & Blasting Practices in Mines, Dr S. K. Das, Lovely Prakashan, Dhanbad.
5. Blast Designing: Theory & Practical, by Bhandari Sushil, Joshi Akhilesh, Rajmeny PK, Himanshu Publications.



**Diploma (Semester-III)**  
**Mining & Mine Surveying**  
**MINE ENVIRONMENTAL ENGINEERING**

**Unit 1**

Mine Atmosphere; Mine gases, Origin and occurrence of mine gases - Pollution of mine atmosphere - Standards of ventilation - Degree of gassiness of mines. Composition of mine air Regulations related Mine Ventilation as per CMR & MMR provisions.

**Unit II**

**Gas Detectors:** Gas detectors, Uses, – principle on which designed, determination of percentage of gas with them- Recent techniques of gas detection – remote sensing devices, continuous recorders, monitors, infra-red spectrometers, sensors-Carbon Monoxide detection – Warm blooded birds, chemical detectors, Multi gas detector

**Unit III**

Mine Ventilation system & Natural Ventilation - Measurement of air quantity, pressure and velocity; Law of air flow in mines, flow of air in ducts and mine roadways, resistance of air ways, Chezy's and Atkinson's equations; Equivalent resistance and equivalent orifice of mine:

**Unit IV**

Mechanical ventilation, different types of fans used in mines, theoretical characteristics of centrifugal and axial flow fans, forcing and exhaust fans, relations between pressure quantity and power Of fan, numerical calculation, fan drift, their constructional feature, auxiliary and booster fans' C011Structional feature, splitting of air current, advantage of splitting, reversal of air current

**Unit V**

Natural Ventilation and its measurements; Thermodynamics of natural ventilation. Distribution and control of air current; Accessories of ventilation used in mines --- Door, regulator, stoppings, air lock, air crossing, brattice

**PRACTICAL: MINE ENVIRONMENTAL ENGINEERING**

1. Determination of relative humidity by whirling hygrometer
2. Determination of cooling power of the mi
3. Ventilation survey problem
4. Air conditioning problem
5. Measurement of air velocity, quantity and pressure in a duct by using a pitot tube.
6. Design and Describe air crossing, regulator, Ventilating door, air lock at pit top etc
7. Different gases found in coalmines, metal mines and their permitted limits as per the mining regulations. Effect of these gases when found in excess
8. Designing auxiliary ventilation system and their comparative performance
9. Calculation for the installation of main ventilation fan and its reversal arrangement.
10. Various air circuits with resistance in series and parallel.

**Text Books**

2. Mine Ventilation by Prof. S.P.Banerjee
3. Mine Ventilation by Prof G.B.Mishra
4. Paryavarana Addhyan: KL Tiwari and Jadhav
5. DGMS circular

**Diploma (Semester-III)**  
**Mining & Mine Surveying**  
**MINE SURVEYING- I**

**Unit I : Surveying and linear measurement**

Definition, Classification of survey, Basic principle of surveying, plan, map, scales, diagonal scales, vernier scales, 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; Cross staff survey, calculating area and plotting

**Unit II : Angular measurement**

**A. Theodolite-I**

Definition, Classification of Theodolite, Main parts of Theodolite, definition used in Theodolite, as axis, centering, transiting, swinging, etc. Temporary and permanent adjustments.

**B. Traversing:** Type of traversing, purpose, classification, latitude and departure, Bearing, calculation of bearing and coordinates

**Unit III: Dial Survey**

Miners dial- Dial and telescopic – Miners dial construction E and W transposed -temporary and permanent adjustment. Booking survey Graphic Method. - Field & line Method. Setting out underground road ways with the help of dial, plotting by protactor, Test for Miners dial, precautions to be taken. Methods used in dial surveying-Loose needle survey-Fast needle survey, meridian.

**Unit IV: Leveling**

Terms used and definition, object of leveling, instrument used in leveling, level tube, gradient, Underground bench mark, datum, subsidence (definition and causes), Temporary adjustment in leveling instrument/ auto level

**Unit V: Dip and strike**

Definition, Dip, Strike, Fault, Apparent dip, Determination of apparent dip, full dip and strike from bore hole data by construction & calculation method

**Text Books**

1. Mine Surveying by S. Ghatak
2. Surveying & Levelling by B. C. Punamia
3. Surveying & Levelling by Kanetkar & Kulkarni
4. Mine Surveying (English, Hardcover, Dr. Anupam Bhatnagar, Himanshu Publications.
5. □□□□□□□□ और □□□□□□ □□□□ Vol. 1 & 2 by B.C.पूनमिया, □□□□  
□□□□ □□□ □□□□ □□□□ □□□,

## **PRACTICAL: MINE SURVEYING- I**

### **A. PRACTICAL'S PROJECTS IN THE FIELD**

1. Theodolite traverses survey.
2. Method of determination of co-ordinates.
3. Close traversing by Theodolite .
4. Study of Miners Dial its constructional features & adjustments
5. Determine the true apparent dip & strike from bore hole data by construction method
- 6.Chain and tape survey -Chain and compass survey
7. Leveling survey
- 8.Plotting by protector
9. Plotting by coordinates
- 10 Chain and compass survey
- 11 constructional feature of theodolite

**Efforts will be made to demonstrate the field use of surveying instruments in nearby mines.**

**Diploma Mining Engineering**  
**Semester-III**  
**MINING LEGISLATION AND GENERAL SAFETY**

**Unit I:**

**Mines Act 1952:** Meaning of the terms, Mine Act, Regulations, Rules, Bye-laws, standing orders, and situations under which act does not apply. Provisions of Mines Act in respect of Drinking water health and hygienic conservancy, Medical Appliances, Hour and limitations of Employment - Leave with wages.

**Unit II :**

**Mines Rules 1955:** Mine Rules related to drinking water, lavatories, urinals with on surface and in underground first aid, - Ambulance, Hours, and limitations of Employment - leave with wages - with wages and over time.

**Unit III:**

**Coal Mines and Metalliferrous Mines Regulations:**

Important definitions, regulations related to notice of accidents duties of managers, Asst/under Managers, Overman, foreman and surveyor, Mine plans and sections. Means of Access and egress ladder and Ladder ways under M.M.R.

**Unit IV:**

Transport of men and material by Haulage mine working precautions against dangers from gas and water Mine ventilation, mine lighting and safety equipment and types of fences (Miscellaneous)

**Unit V:**

**Safety Aspects in Mines:**

Accidents classification and analysis-safe condition- unsafe condition- mine safety- safety objectives-major factors to be considered for safety - safety week- pit safety committee- safety organization and safety policy.

**REFERENCE BOOKS**

1. Mine Management, Legislation and Ground safety : S.Ghattak.
2. Mine Management : V.N.Singh
3. Mines act 1952
4. Mines rules 1955
5. CMR/MMR 1957 / 61
6. Critical Appraisal : Rakesh & Prasad
7. DGMS Circulars

**Diploma (Semester-IV)**  
**Mining & Mine Surveying**

**METHOD OF WORK (COAL)**

**Unit I:**

**Bord and pillar method Development:** Bord & pillar system ,Application , Merits , Demerits ,Different terms ,stages of development , depillaring stages , Application of panel system , types of panels , factors influencing the size of panel system , General Considerations , factors influencing the no. of openings of panel , merits and demerits of panel system , Factors governing the selection of development method , factors governed while opening of a district , Panel development with three headings and , Different methods of development systems along dip, strike, crosscuts, steeply dipping seams, loaders, belt conveyer load haul dumpers, belt conveyers chain conveyors. Arrangements for ventilation of Road header.

**Unit II:**

**Bord and Pillar method– Depillaring:** Important terms , classification ,planning preparation arrangements , sequence of operations , Pillar extraction under weak roof condition , mechanized method of Pillar extraction by LHDS, SDL, scraper chain, conveyor systems , size, shape of pillars, ribs , local fall main fall, air blast, dangers, precautions , method of stowing conditions required for adopting stowing , preparation arrangement for stowing , lay out of panel with stowing , used of fly ash as stowing material ,danger and precautions while working below goaf areas , contiguous seams extraction , precautions against fire during and after depillaring. Depillaring with continuous miner.

**Unit III:**

**Long Wall:** Long wall methods( advancing , retreating ,punch longwall), Terminology, Application, merits, demerits, limitations.  
Long wall advancing indicating its application, comparison between Long wall advancing and Long wall retreating.

Development of gate roads, machinery employed on a mechanized Long wall face continuous mining methods, different factors governing the length of Long wall face, lay outs of mechanized long wall face advancing with caving, layout of mechanized long wall face advancing with stowing.

**Unit IV:**

**Long Wall Retreating Method:** Long wall retreating and its application & selection. Layout of mechanized long wall face retreating- with stowing & caving. Layout of long wall face equipped with shearer (SERD&DERD), Cutting methods of the Shearer in longwall mining, methods of sumping in long wall face extraction, method of push, sumping in longwall face extraction, salvaging operation .

**Unit V:**

**Thick seam working:** Definition- selection & application. Methods- inclined slicing with caving/stowing , Horizontal slicing with caving / stowing , Blasting gallery method sub, level caving with mechanized long wall , Horizon mining , Selection & Application. Use of plough, hydraulic mining- Underground gasification of coal, method of extraction of contiguous seam. CBM-CMM-Definition, status in India, selection, methods of extraction, safety precaution as per CMR2017

**Practical:**

1. Layouts of underground mine
2. Draw a pit,top & pit Bottom layouts of shaft,
- 3.Layout of Bord and pillar showing
- 4.development work and ventilation network,
- 5.Layout of Bord and pillar
- 6.showing method depillaring and ventilation network,
- 7.layout of longwall retreating method
- 8.layout of Blasting Gallery panel.
- 9.Calculate the percentage of extraction for depillaring work,
10. Layout of CM district

**Reference books:**

1. Elements of Mining Technology Vol.I : D.J.Deshmukh
2. Wining and working coal : R.T. Deshmukh & D.J. Deshmukh, Vol. 1&
3. Longwall Mining : Samir Kumar Das
4. Modern coal Mining Technology : Samir Kumar Das
5. Principle &Practices of Coal Mining ; R.D. Singh
6. Coal Mining practice : Stathum
7. Surface Mining Technology : Samir Kumar Das.
8. Surface Mining : T.N.Singh

**Diploma (Engg.)**  
**Mining & Mine Surveying**  
**Semester-IV**  
**Mine Electrical Engineering**

**Unit-I:** Introduction -Basic electrical engineering, Faraday's law of electromagnetic induction, D.C. Generator, EMF equation, type of generator, A.C. fundamental, basic idea of alternators (type, equation of emf), power factor, power triangles, method improving p. f. Resistance/ Capacitor/Inductance, RLC circuit,

Fundamental of transformer 1- $\emptyset$ ,3- $\emptyset$  emf equation, transformation ratio ( $K = \frac{e_2}{e_1} = \frac{n_2}{n_1} = \frac{i_1}{i_2}$ ) numerical on it. KVA rating and calculation. Open/short circuit test of transformer. Maximum efficiency, Losses in transformer, concept of  $\frac{\Delta}{\Delta}$ ,  $\frac{\Delta}{\Delta}$ . Connection of transformer.

**Unit-II:** 3-  $\emptyset$ . Induction motor (sq. cage/slip-ring)., method of starting.  $\frac{\Delta}{\Delta}$  starter, auto transformer starter, Rotor resistance starter, slip, torque, losses, efficiency.  
Double revolving theory, Single phase induction motor/working principles Synchronous Motors: Methods of starting, operation of synchronizing motor as a condenser and as a reactor, Application in Industries and Mines

**Unit-III:** Transmission and Distribution of Electrical Power in Mines concept of EHT, HT, LT voltages: Performance of short transmission lines; radial and ring-main distribution systems, line diagram from generation to load centre. Substation arrangements for opencast and underground mines, distribution of electrical power in mines, cables used in mines.

**Unit IV :** Mining type switchgears and protective devices: Types of circuit breakers, Gate end box, Drill panel, and Tran switch, Field Switch. Symmetrical faults and circuit breaker rating calculation. Protective relays: Thermal and induction disc type overload relays; mining type earth fault relay. Signaling and communication: basic concept of underground mine communication, Haulage and Coal face signaling systems for underground coal mines,

**Unit-V:**Electrical Safety in Mines: Concept of neutral and earth ,Neutral Grounding and Equipment earthing practice in mines, principles of flameproof enclosure, intrinsic safety, Indian Electricity Rules as applied to mines – mainprovisions. Mine lighting system.

## **PRACTICAL: MINE ELECTRICAL ENGINEERING**

1. To study constructional detail of DC Machine.
2. To obtain Magnetization Characteristics of DC Generator.
3. To obtain load Characteristics and Voltage Regulation of Transformer.
4. No load test of a transformer.
5. Short circuit test of a transformer.
6. No load/load test of a 3-Ø. Induction motor, slip calculation.
7. Study and operation of a single phase motor.
8. Displaying modulated & de- modulated signal on CRO & calculation of their frequency
9. Measurement of insulation resistance by meggar (cable/motor).
10. Measurement of earth resistance by earth tester.

### **Text Books**

1. Nagrath and Kothari. Electrical Machines
2. Ashfaq Hussain. Fundamentals of Electrical Engineering
3. Practical Guide to Energy Conservation : PCRA Publications (Unit V)
4. Electrical Engineering in Mines, by N.K.Datta



**Diploma (Engg.)**  
**Mining & Mine Surveying**  
**Semester-IV**

## **Mining Hazard & Safety**

**Unit-I:**

**Methane layering:** Definition of methane drainage, Different methods of methane drainage, from working seam. Drainage of methane from virgin coal seam. Definition of outburst of coal and gas. Causes of outburst of coal and gas. Prevention of outburst of coal and gas.

**Unit-II:**

**Mine Explosions:** Types of mine explosions-Causes and preventive measures, coal dust explosion-causes and preventive measures, Treating coal dust by watering and stone dust barriers – water barriers. **Fire Damp Explosions:** Limits of inflammability & statutory aspects. Influencing the same, Causes of fire damp explosions, Preventive measures. Water gas explosion.

**Unit-III:**

**Rescue and Recovery:** Rescue and recovery operations in mine, Objectives and classification of rescue apparatus, self contained (Compressed oxygen) breathing apparatus. Smoke helmet & its construction details. Gas mask, self rescuer, purpose of resuscitations apparatus, Tests before and after using rescue apparatus, Rescue stations-equipment required, Rescue organization construction and function

**Unit-IV:**

**Inundation:** Inundation in mines, Dangers different sources of water-precautions against surface and underground water, precautions-while approaching water logged area, Burn side safety boring apparatus, Accident due to Inundation in chasanala(Dhanbad) accident.

**Unit-V: Regulations:**

Regulation related to Mine inundation CMR-126,127. Regulation related to mine gas, fire and self heating etc.

**Text & Reference Books:**

1. Elements of Mining Technology Vol-2, D. J. Deshmukh
- 2 Mine Disasters and Mine Rescue – M.A. Ramlu, Oxford & IBH, New Delhi.
3. Hand book on First Aid, Published by Multi Disciplinary Centre on Safety, Health & Environment, Bhubaneswar
- 4 Mine Safety & Legislation, by S.K.Das, Lovely Prakashan, Dhanbad. 5 Mine Rescue Rules.

**Diploma (Semester-IV)**  
**Mining & Mine Surveying**  
**Mine Environment II**

**Unit I :**

**Mine fires** Classification, causes, preventive measure, spontaneous heating- causes and preventive measures. Different methods of dealing with fire Permanent sealing of Fire. Collection of samples behind fire seals – Interpretation of samples – Coward’s diagram, calculation of CO/O<sub>2</sub> deficiency ratio, reopening of sealed off areas Fire fighting equipment and organization.

**Unit II**

**Ventilation plan & Continuous Monitoring of Ventilation System**

Determination of the ventilation efficiency quotient (VEQ), ventilation survey, ventilation plan, crossing point temperature, Continuous recording and monitoring of Air velocity and Quantity-Tele monitoring systems – Advantages – disadvantages of it. Important regulation related to mine ventilation.

**Unit III:**

Heat and humidity in mine atmosphere and their effects; cooling power of mine air Dust - Generation/Sources - Control - Dust monitoring - Dust Survey.

**Unit IV :**

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 as well as ungrounded mines exactly as per statutory norms

**Unit V:**

**Miners Diseases.** Different types of notified miner’s diseases, diseases due to inhalation of dust in mines causes and preventive measures of pneumoconiosis silicosis, siderosis, manganese poisoning, lead poisoning, Chromium poisoning. Harmful effects of radioactive minerals- causes and preventive measures of nystagmus and Anky-lostomiosias.

## **PRACTICAL: MINE ENVIRONMENT II**

1. Identifies the parts of flame safety lamp - Tests for the presence of inflammable gas accumulation - different types of flame safety lamps
2. Determination the percentage of methane using methanometers-Determines the percentage of CO using Co Detectors (chemicals)- Determination the percentage of other gases using multi-gas detectors
3. Draws the performance/characteristic curves of mine fans from the observations made by conducting appropriate experiments-
4. Measurement of air velocity with the help of anemometer,velometer
5. Determination of the ventilation efficiency quotient (VEQ)
6. To prepare a mine ventilation plan & Determine the cooling power of mine air
7. Study and sketch fire fighting equipments for class A, B,C, D, E Fires.
8. Collection of mine air sample from different parts of the mine by using water displacement methods, pipette and aspirator and vacuum bottles
9. Analysis of the air samples for the presence of various noxious gases- Graphs from results of the analysis of mine air samples from behind the sealed off areas of CO wards diagram.
10. Measurement of relative humidity with the help of various types of hygrometer

### **REFERENCE BOOKS**

1. Mine fires, Rescue, Recovery and Inundation M A. Ramulu
2. Mine ventilation S. Ghatak
3. Mines Rescue rules
4. Mine ventilation Hartmen
5. Mine ventilation G.B. Mishra
6. UMS Volumes
7. Statham series
8. Mine management, Legislation and General safety S.Ghatak
9. Mine environment and its control G B Mishra
10. Mine Management VN.Singh
11. Industrial Management O.P.Khanna
- 12.SME Mining Engineering Hand Book-vol –I & vol-II

**Diploma (Semester-IV)  
Mining & Mine Surveying**

**GEOLOGY-II**

**Unit I:**

**Stratigraphy:** Definition: objectives of Stratigraphy, Geological time scale. Physical divisions of India. major Stratigraphical divisions of India. Archeans, Dharwar, Cuddapah, Vindyan, Gondwana systems, Fossil: Definition, mode of occurrence, uses of fossils.

**Unit II:**

**Economic Geology:** Definition of forms of Ore, Gangue, Tenor, associated mineral resources, proved, probable, possible reserves, different process of Mineralization, important Economic minerals; Metallic and Non Metallic Minerals.

**Unit III:**

**Prospecting Techniques:** Objectives: Guide lines for location of mineral deposits, prospecting methods principles, Applicability's of pitting, trenching, Drill cutting, Boring, Geophysical methods, Electrical, gravity, Seismic, Radiometric, G I S and Remote Sensing.

**Unit IV:**

**Know about the coal geology:** Objectives: State the Periods of coal Formation, Mention the different Stages of Coal formation, Explain the Origin of Coal Seams-Explain the In situ Theory, Explain the Drift Theory, Describe the Structural Features of Coal Seams-Give the Classification of Coal- Name the world coal fields-Describe the coalfields of India

**Unit V:**

**Know about the Petroleum Geology:** Know the importance of Petroleum as Fuel- State the Origin of Petroleum-State the Migration and Accumulation of Petroleum-State the distribution of Oil fields in the world- State the distribution of Oil fields in India.

## **PRACTICAL: MINING GEOLOGY-II**

1. Megascopic Study and Physical Identification of Non-Metallic Minerals by their physical properties.
2. Megascopic Study and Physical Identification of Metallic Minerals by their physical properties.
3. Microscopic Study and Identification of Non-Metallic Minerals by their Optical properties
4. Microscopic Study and Identification of Metallic Minerals by their Optical properties
5. Megascopic Study and Physical Identification of different kinds of Coals by their physical properties.
6. Microscopic Study and Identification of different kinds of Coals by their Optical properties
7. Estimation of Ore Reserve .
8. Estimation of Coal Reserve .
9. Estimation of Oil Reserve .
10. Locate and Distribute the various Economic Minerals in India On Indian Map.

### **REFERENCE BOOKS**

1. Text Book of Geology ; P.K.Mukharjee
2. Mining Geology : Arogya Swami
3. Engineering Geology : Parbin Singh
4. Text Book of Coal Geology: R.S. Sharma

**Diploma (Semester-IV)  
Mining & Mine Surveying**

**ADVANCED MINE SURVEYING**

**Unit I:**

**Theodolite:** bearing & type of bearing of lines. Traversing – continuous Azimuth, double fore sight methods – computation of bearings of traverses check of accuracy in angular measurements – permissible error – distribution – calculation of latitude and departure – problems on rectangular coordinates – calculation of areas – Bowditch Rule and Transit rule.

**Unit II:**

**Triangulation:** Definition – Principles – classification mine Triangulation – scheme of Triangulation – Checks for measuring angles in Triangle – selection of stations – points considered for selection of stations – Baseline measurement in catenary, on level ground – Correction applied on base line determination of true north by astronomical observation method of extension of base line and prolongation of base line.

**Unit III:**

**Setting Curves:** Classification – Definitions – elements of simple curve – Method of setting out curves – by chord and offset, chord and angle related numerical.

**Correlation survey** - Purpose – methods of correlation – Direct Traversing – Co – planning – weisbach Triangle and its related problems.

**Unit IV:**

**Tachometry and Leveling**

**Tachometry:** Principles – systems – Constants Methods – Stadia method, subtense method, Tangential method – merits and demerits of Tachometry – relation between stadia reading, Horizontal distance, vertical distance, solves problems.

**Leveling:** Method of leveling rise and fall method height of instrument method of booking. Level related problems and plotting of sections.

**Unit V:**

**Stope Survey**-Objectives – Methods – Tap Triangulation – Field of application –Radial Ray method stope plans with details

**Modern surveying Instruments :-** Principle of working of - EDM – GPS – Total station Instrument – applicability in Mines. Traversing by total station.

### **PRACTICAL: ADVANCED MINE SURVEYING**

1. **Know the traversing** - Conducts traverse survey by direct bearing method by meridian method and rectangular method.
2. Traverse survey by double foresight method-Plot the traverse by meridian method and rectangular method.
3. **Know the Triangulation** - Extension of the given base line/
4. **Know the Triangulation** Prolongation of base line.
5. **Know the Curve Setting** - Sets out curve by chord and offset.
6. **Know the Curve Setting** Sets out curve by Chord and Angle.
4. **Know the Tachometry survey** - Determines the tachometric constants.
5. **Know the Tachometry survey** R.L of points by fixed hair method.
6. **Know the Tachometry survey** R.L.s of points by tangential method.
7. **Plotting of various surveying field results** - Plotting of triangulation survey of the given area.
8. **Levelling:** Carry out profile levelling survey of the given area and plot its cross section.
9. **Levelling:** Carry out subsidence survey on a given area and plot the subsidence profile.
10. **Levelling:** Plot the contours of the given area.
11. **Study of the Modern Survey Equipment** - Principle of working of GPS Instrument.
12. Traversing by total station and plotting by coordinate system.
13. **Survey Camp** - Correlation survey-Subsidence survey-Triangulation-Traversing-Determination gradient of a roadway-Setting out curves.

### **TEXT & REFERENCE BOOKS**

- |                  |                         |
|------------------|-------------------------|
|                  | Kanetkar & Kulkarni Vol |
| 1.Surveying :    | 1,2                     |
| 2.Surveying      | Punmia Vol. 1,2,3       |
| 3.U.M.S. Volumes |                         |
| 4.Surveying :    | Ghatak Vol.1,2,3        |

**Diploma (Semester-V)**  
**Mining & Mine Surveying**  
**Mine Sampling Assaying and Mineral Processing**

**Unit I .**

**Mine sampling and assaying:** Definition, terms, purpose and various uses. Different Sampling methods. Salting-purpose, safety against salting. Reduction of sampling- Methods used, Errors in sampling. Introduction to assaying – assay map, assay plan factor, assay values, grade value, tenor, type of grade value. Calculations based on average assay value. Estimation of ore reserves.

**Unit II:**

**Mineral dressing:** Scope, objectives & limitations of Mineral Dressing. Comminution- Crushing – primary & secondary, screening, Size separation.

**Unit III**

**Mineral Processing Methods:**

Gravity concentration methods. Introductory froth floatation. Magnetic separation etc Simplified flow sheets of coal, copper, Lead & zinc, iron, lime stones (Briefly).

**Unit IV :**

**Coal washing/ beneficiation :** Cooking and non cooking coal, Grading of coal characteristics of Indian Coal, Why Coal processing is needed ? Constituents of coal and their role – Specification of coal to be used in steel plants (for coking coal) and other plants (power plants, cement plants etc).

**Unit V :**

**Coal quality & Beneficiation methods:**

Coal quality improvement while mining and its advantages, Coal handling, Dry coal beneficiation, Wet coal beneficiation.

**PRACTICAL: MINE SAMPLING ASSAYING AND MINERAL PROCESSING**

1. Study of sampling methods.
2. Study of constructional features of jaw crusher.
3. Study of different types of tumbling mills.
4. Study of froth floatation.
5. Study of Gravity concentration methods.
6. Study of magnetic separation.
7. Study of various flow sheets.
8. Study of various coal processing methods (dry beneficiation)
9. Study of wet coal beneficiation process.

**Reference Books:**

1. Mineral dressing Gaudin
2. Mahapatra C. Fundamentals of mineral dressing. A concise basic course JTT Publishers, Third edition. 2015
3. Element of mining D.J.Deshmukh
4. Courses in mining Geology: Arogyaswamy



**Diploma (Semester-V)**  
**Mining & Mine Surveying**  
**MINING MACHINERY – I**

**Unit I:**

**Wire Ropes** - Usage, chemical composition, infield tests of wire, classification of wire ropes, Application of different ropes - causes of deterioration, precautions, selection parameters, computation of numerical problems on size - Weight and strength of wire ropes. Capping and recapping of wire ropes, classification - description of capping methods - splicing methods, description of splicing.

**Unit II:**

**Winding of Men & Material** - Winding in shafts – purpose, equipment, Types of had gear frames –Shaft fittings – guides in the shafts – pit – top arrangement – keps and suspension gear – Types of drums. Head gear pulley, Cage & Skip winding-pit-top and pit-bottom arrangements

**Unit III:** Types of Winding system

Drum winding and skip winding, multi-deck winding and friction winding – Drum and friction winding – Winding engine – safety devices on winder– Methods of speed control – Braking in winding – Types of brakes

**Unit IV:**

**Transportation in Mines -Rope Haulages** - factors of selection for rope haulage. comprehensive classification of transportation - ROPE HAULAGE - direct Rope Haulage System, merits, demerits and applications - safety Devices in Direct Rope Haulage system-Endless Rope Haulage System, merits, demerits - Laying and maintenance of track. Constructional details of mine tub/car, Computation problems for determination of H.P. rope size breaking strength, Tub capacity, number of tubs.

**Unit V**

**Transportation in Mines** - Conveyor Type- belt conveyor – pipe conveyor- belt constructions, safety devices, merits & demerits -Numerical problems. Scraper chain conveyor system. Locomotives & types of locomotive systems, merits, demerits, Aerial Rope Ways. Shuttle car , Man riding system

*Along with these topics provision of CMR & MMR & DGMS Notification /circular shall be consulted*

### **PRACTICAL: MINING MACHINERY – I**

1. To study of different types of wire rope its composition & uses in mining.
2. Process of changing of winding rope and its requirement as per regulation.
3. To study of Direct rope haulage system with figure.
4. Study of Endless rope haulage system & its designing aspect with figure.
5. Study of various types of safety devices in haulage system.
6. To study the different types of winding system and their comparative application.
7. Study of different types of locomotive & its application.
8. Study of different types of conveyors with their design parameters & uses in mines.
9. To study the different method of speed control in winding system.
10. Study of different types of Aerial ropeway & its uses.

### **TEXT & REFERENCE BOOKS**

1. Handbook of Metalliferous Mining Methods by Y.P.,Chacharkar, Lovely Prakashan, Dhanbad.
2. Elements of Mining Technology, D.J.Deshmukh Vol.3
3. Mine Transport by Kerlin
4. Handbook of Metalliferous Mining Methods by Y.P.,Chacharkar, Lovely Prakashan, Dhanbad.
5. Elements of Mining Technology, D.J.Deshmukh Vol.3
6. Mine Transport by Kerlin
7. Introduction to Mining, G.K.Pradhan, Mintech Publications, Bhubaneswar

**Diploma (Semester-V)**  
**Mining & Mine Surveying**  
**Advanced Mine Surveying-I**

**Unit-I**

**Contour Concept-** Definitions; Characteristics of contours; Tachometric Contouring -Fieldwork, Interpolation of contours; Plotting and interpretation of contours. Method of contouring. Volume calculation by using contour map and profile Leveling.

**Unit-II**

**National Grid**

Map projection , Cassini Lambert's poly conic & universal transfer of Mercator , transformation of coordinates , subsidence survey method Objectives, introduction of photogrammetric

**Unit-III**

**Computation of area and Volume-** measurement of area and volume by trapezoidal and Simpson formula. Calculation of area by mid ordinate and average ordinate rule. Area calculation using planimeter and digital planimeter. Types of cross section and areas, reserve calculation

**Unit-IV**

**Application of Automation & IT in surveying:** Data acquisitions; Preparation of plans and sections; Calculation of earth works, Introduction to Surveying software's, Surveying by auto plotter technique.

**Development Surveys:** Control of direction and gradient in drifts, survey for tunneling,

**Unit-V**

**Shaft Surveying-** Determination of depth of shaft, method of checking verticality of shaft, Preparation of a ventilation plan and underground plan as per regulation. Detail traversing of underground and plotting the area. Symbols as per CMR&MMR used for preparation of plans & Section.

**Gyro-North Determination:** Principle of Gyro-theodolite/Gyromat; Determination of Gyro-north.

## **PRACTICAL: ADVANCED MINE SURVEYING-II**

1. Exercise on contouring and plotting of contour map.
2. Calculation of area of map with the help of planimeter.
3. Traversing of an area and calculation the area with the help of coordinate system.
4. Application of GIS software in mine surveying.
5. Study of ventilation plan of a underground mine.
6. Study of a surface plan of mine.
7. Study of contour map and toposheets.
8. Determination of depth of shaft and its verticality.
9. Preparation of ventilation plan
10. Determination of area by total station

### **TEXT & REFERENCE BOOKS**

- |                  |                         |
|------------------|-------------------------|
|                  | Kanetkar & Kulkarni Vol |
| 1.Surveying :    | 1,2                     |
| 2.Surveying      | Punmia Vol. 1,2,3       |
| 3.U.M.S. Volumes |                         |
| 4.Surveying :    | Ghatak Vol.1,2,3        |

**Diploma (Semester-V)**  
**Mining & Mine Surveying**

**Mining hazard safety and legislation**

**Unit I**

Preventive measures against dangers, mine boundary and barriers, panel barriers, water dams, calculation of dam size and construction. Approaching water logged workings and its precautions, long bore holes by burn side Boring apparatus and its safety and statutory aspects. Standing order in the event of stoppage of MMV and occurrence of fire in u/g mine

**Unit II**

Mine rescue and recovery work- selection of rescue team, initial and refresher training, emergency Organization, rescue procedure in different situation, recovery search for survivors their rescue work , Accident to mine rescue brigade member, Clearing dead bodies and re-establishing system connected with immediate rescue operation

**Unit III**

Actual operation for survival technique, use of bore hole in rescue operation, rescue plan water danger plan, conventional sign of schedule fifth of Rescue Rule, adjusting and test of breathing apparatus, flow meter, bobbin meter oxygen etc.

**Unit IV**

Rescue chamber, refuge station or refuge bay, barricades. Composition of safety committee, function of safety committee work men inspector, duty of work- men inspector, provision of canteen

**Unit V**

- A. Important regulation of CMR 2017 such as CMR 88,92,111,112,113,118,119,121,123,124,159,160,161,166, 167,168
- B. Course of training by the use of self rescuer , conditions & other detail of methane gas transportation in below ground (CMR230),
- C. Condition for deep Hole blasting in OCM(CMR194)
- D. Condition for conducting blasting in fire area in OCM(CMR202)

## **PRACTICAL: MINING HAZARD SAFETY AND LEGISLATION**

1. Study of constructional features & working of self contained breathing apparatus.
2. Study of various types of Fire Extinguishers used in Mines.
3. Study of constructional features & working of self Rescuer.
4. Study of constructional features & working of Gas Mask.
5. Study of constructional features & working of Reviving apparatus.
6. Study of working of Burn Side Safety Boring Machine.
7. Study of constructional features & working of Stone Dust Barriers.
8. First aid training to be explained and conducted.
9. Water barrier.
10. Emergency organization in underground mines.

### **Text & Reference Books:**

P.Seshagiri Rao, Law of Mines & Minerals. Pub: Asia Law House, Hyderabad  
Rakesh & Prasad, Legislation in Indian Mines Vol. I & II. Pub: Mrs. Asha Lata Varanasi  
Classified Mine Circulars Issued by DGMS (Compiled)  
Relevant Act, Rules and Regulations, Published by Govt. of India  
Elements of Mining Technology Vol-2, D. J. Deshmukh  
Mine Disasters and Mine Rescue – M.A. Ramlu, Oxford & IBH, New Delhi.  
Hand book on First Aid, Published by Multi Disciplinary Centre on Safety, Health &  
Environment, Bhubaneswar  
Mine Safety & Legislation, by S.K.Das, Lovely Prakashan, Dhanbad.

**Diploma (Semester-VI)  
Mining & Mine Surveying**

**ROCK MECHANICS AND STRATA CONTROL**

**Unit I:**

Definition of rock mechanics – scope of Rock mechanics Application of Rock mechanics to mining field.

Rock Properties – Physical, Mechanical, Properties of rocks – compressive strength – Tensile strength- Shear strength – strength indices of rocks – Point Load Strength Index- Protodyakanov Strength Index(PSI) – porosity & permeability Anisotropy –

**Unit II:**

Ground Forces, Stress Analysis, Stress distribution: Various forces acting on block – types of Stress – Relation between vertical and lateral stresses – Stress field – Hydrostatic and Litho static stage of rock. Induced stresses due to Mining – Stress distribution around narrow and wide openings – Instruments used for measurement of stress – Stress distribution around road way.

**Unit III:**

**Strata and ground movements:** Strata conditions before and after mining operations – Theories of mechanics of Strata behaviour – Strata pressure in and around Bord and pillar and long wall workings. RQD, Rock Mass Rating of roof strata (RMR), Slope Mass Rating (SMR). Instrumentation for measuring ground movement .

Classification of rock stability – theories of rock failure . Bumps – rock burst – Theories– Causes – Preventive measures.

**Unit IV:**

**Subsidence:** Definition of various terms – Angle of draw positive or negative, factors influencing angle of draw – factors affecting subsidence – damages – Protective measures – Subsidence measurements –surface Movements and Deformation during depillaring& Longwall Mining,

**Unit V:**

**Strata control:** Supports – Necessity– Classification & Application- Principle of roof bolting, stitching, cable bolting, short creating– Rigid and Yielding props – constructional details of Friction, Hydraulic props – Method of setting, testing & withdrawal – Fore polling, safari support- Junction Supports – Clearance of Heavy roof Collapse – Strata Monitoring Plan (SMP)

## **PRACTICAL: ROCK MECHANICS AND STRATA CONTROL**

1. Procedure for the determination of compressive strength and point load index of given rock samples.
2. Measurement of Schmidt rebound hardness and its application.
3. Procedure for the determination of slake durability index of given rock samples.
4. Brazilian Test - determination of tensile strength of given rock samples of by
5. Procedure for the determination of shear strength and triaxial properties of rock
6. Measurement of core recovery and RQD.
7. Determination of RMR of given field data
8. Determination of Protodykonov Strength Index of given rocks

## **TEXT & REFERENCE BOOKS**

1. Rock Mechanics, by Richard E. Goodman.
2. Rock mechanics and strata control, by B.S.Varma
3. Elements of Mining Technology, by D.J.Deshmukh & R.T.Deshmuk Vol 1,2,3
4. Wining and working Vol 1,2
5. Rock Mechanics & Ground Control, by D.Biswas, Lovely Prakashan, Dhanbad.
6. Rock Mechanics for Practicing Engineers, Eds: A.K.Verma, D.Dev & KUM Rao, Published by Deptt. Of Mining, IIT, Kharagpur.



**Diploma (Semester-VI)**  
**Mining & Mine Surveying**

**MINE MANAGEMENT AND MINE ECONOMICS**

**Unit 1**

**Management and Organisation:** Concept of management; Principle of scientific management; functions of management; future challenges for management; organisational structure for mining enterprise; selection, training and development of human resources; ownership of mines.

**Unit 2**

**Entrepreneurship:** concept of entrepreneurship; entrepreneurs vs entrepreneurship; innovation and entrepreneurship; motivational factors in entrepreneurship; risks and rewards; self employment schemes; site selection; plant layout; setting up of a mine; market survey and research; feasibility study; man power requirement; techno economics and cost factors.

**Unit 3**

**Work Study and Production Management:** Principle, scope and necessity of work study; method study – concept and advantages; motion study; concept and principle of time study. Production planning, scheduling and control; short term and long term planning; concept of productivity and its measurement.

**Unit 4**

**Mine Economics and Mine Valuation:** Concept of mine economics; mining industries and India's economic development; concept of mineral resources and their classification; consumption, substitution and conservation of mineral resources; infrastructures in mining areas; status of small mines. Basic concept of mine valuations; earlier approaches to valuation; recent approaches to valuation.

**Unit 5**

**Quality Management and N.M.P.:** Concept of quality; total quality management; ISO concept; Concept of six sigma; advantages of quality improvement in mining. Objectives and elements of a national mineral policy; national mineral policy of India.

**Recommended Books**

- 1 Singh, V. N, Mine Management.
- 2 Holt, D. H, Entrepreneurship – new venture creation.
- 3 Deshmukh, R. T, Mineral and Mine Economics.
- 4 Chaterjee, K. K, An introduction to mineral economics.
- 5 Kumar, A, Mine Economics.

**Diploma (Semester-VI)**  
**Mining & Mine Surveying**

**Mine Electrical Engineering & Energy & Savings in mining**

**Unit I :**

**Surface Sub-Station:** Transmission lines from power company, their performances, Distribution on surface - General surface substation for underground mine/quarries. **Underground Power Installation:** - Distribution of power in quarries and mines – Underground distribution - Substation planning.

**Unit II :**

**Mining Switch Gears:** Gate and box - Pillar switch - Drill panel. **Mining Cables & Earthing Practice:** - Types of cables - Construction and applicability, safety features - Type of earthing used in mines - Main features, applicability and construction.

**Unit III :**

**Miscellaneous:** - Flame proof enclosure - Intrinsic safety - Symmetrical faults and circuit breaker equipment, Calculations - Principle of thyristors and their application to mines device – Load factor, diversity factor . **Indian Electricity Rules:-** Terms and definitions - Voltage limits, etc. Role of DGMS in electrical energy use in mines.

**Unit IV:**

**Energy Resources & Savings in mining** – Energy ,Types ,Occurrences, Classification , Use of Energy in Mining , Use of electrical energy in underground mines, Cost of energy in mining ,Energy saving in mining and other areas- Energy Audit. Energy Conservation Act, Bureau of Energy Efficiency.

**Text & Reference Books**

1. UMS
2. Mine Electrical By N.K. Dutta
3. Practical Guide To Energy Conservation : PCRA Publication, New Delhi

## Diploma (Semester-VI)

### Mining & Mine Surveying

#### MINING MACHINERY – II

##### Unit I :

**Coal face machinery** a) Hand held drills – classification Electronic Rotary drills: Hammer Drills, Epicyclical gear Arrangement-b) Power Loader – Types of loaders, field of applications, working operation-Principle, design and application of long wall face machinery shearer, AFC, Lump breaker – stage loader, power pack self advancing chock shield supports- SERDS and DERDS- their applications.

##### Unit II :

Principle of working of AFC (Armoured Face conveyor)- names the constituent parts of AFC- application of Twin Bord AFC, bottom closed AFC- safety devices associated with AFC drive- principle of lump breaker- purpose of power pack- Sequences of overburden Movements in a long wall Panel- classification and capability of the immediate roof in long wall panel- Abutment Pressures in long wall mining- classification of Powered supports in long wall mining- factors governing the selection of power supports- purpose of the following in Power supports  
a) Canopy b) Caving Shield c) Lamniscate Links d) Extension Canopy e) Face Guard  
f) Double acting Advancing Ram- composition of Hydraulic fluid- types of Hydraulic control systems.

##### Unit III :

Flameproof and intrinsically safe apparatus- Outlines the necessity, FLP vs intrinsically safe apparatus field of application, Frame proofing – constructional features methods of intrinsic safety field or application Remote control principle. Principle of thyristors and their application to mines device – Load factor, diversity factor . Indian Electricity Rules:- Terms and definitions - Voltage limits, etc. Role of DGMS in electrical energy use in mines. Signalling-Method of signalling in mines – electrical signalling, circuit indicators – Mining telephones operation.

##### Unit IV :

Surface Sub-Station: - Transmission lines from power company, their performances, Distribution on surface - General surface substation for underground mine/quarries.Underground Power Installation: - Distribution of power in quarries and mines – Underground distribution - Sub-station planning. Mining Switch Gears: Gate and box - Pillar switch - Drill panel. Mining Cables & Earthing, Practice: - Types of cables - Construction and applicability, safety features - Type of earthing used in mines - Main features, applicability and construction.

##### Unit V :

**Mine Pumps:** Pumping - Various terms of pumping, classification of pumps - centrifugal pump fittings - Turbine pump, fittings - Eudthrust - submersible pump - fittings Roto Pump, merits limitation - Selection of pumps - computation of numerical problems on Head, Quantity, H.P. Frictional losses.

## **PRACTICAL: MINING MACHINERY – II**

1. To study the different type of power support with its merit and demerits.
2. To study the different type of shearer and its constructional detail.
3. To study about the silent feature of coal drilling machine.
4. To study about the construction of different type of cable.
5. To study about the centrifugal pump and its principle of working.
6. Turbine pump and its principle of working
7. To study about the submersible pump and its fitting.
8. To study about the different type of signalling system used in mines.
9. To study about the flameproof apparatus and its construction.
10. To study about the layout of surface substation.

### **Text & Reference Books**

1. Elements of Mining : D.J.Deshmukh Vol.3
2. Science and Art of Mining Digest
3. U.M.S.Volumes
4. Statham series VOL III
5. Mine transport by : KERLIN
- 6 Introduction to mining engineering : HARTMEN

**Diploma (Semester-VI)**  
**Mining & Mine Surveying**  
**METAL MINING**

**Unit - I**

**Basic concept of Metal Mining and Development of Mineral Deposits** Ore Mineral – Gangue – Comparison between coal, metal Mines. Dividing mineral ore body- Hanging wall – foot wall – Ore pass – Ore bin – Ore chute, Raise – Winze — Levels – formation of blocks -Shaft Station

**Unit II**

**Development of Mineral Deposits**

Levels into sub levels ,Positions of drives – Footwall - Laying initial haulage – haulage inclines - Handling waste rock - Hand drills and air legs – drifters and Jumbos – Tunnel Boring - Arrangements for loadings and hauling of broken rock, Conventional and mechanized methods of raising, jora rise method.

**Unit - III**

**Stoping Methods**–Classification of stoping systems, Selecting stoping method- Breast stoping, under hand stoping, overhand stoping, open stope stoping. Shrinkage stoping, Sub level stoping, Vertical crater retreating method. Sublevel slicing, Ring hole drilling,

**Caving methods**- block caving , sub- level caving ,

**Unit –IV**

**Cut & Fill methods**- selection of methods- horizontal cut & fill , post & pillar , selection of fill material- mill tailing & paste fill-precaution against stability of fill material

**Problems associated with Deep Mining**- Deepening–difficulties associated remedial measures. Heat and humidity and dust in deep mines – working remedial measures- conversion of open cast to underground metal mining.

**Unit -V**

**Special method** –Ore & heap leaching , solution mining ,

**Sampling** - Objectives and principles, mining situations – classification of sampling methods basing on collection. Stope sampling, channel sampling chip sampling, bulk sampling, drill sampling, Salting, Assaying and Assay plan

## **PRACTICAL: METAL MINING**

1. Pit bottom and pit top layout around a vertical shaft and inclines.
2. Study and draw sketches of Breast stoping,
3. Study and draw sketches of under hand stoping, .
4. Study and draw sketches of Shrinkage stoping,
5. Study and draw sketches of Sub level stoping,
6. Study and draw sketches of vertical crater retreating method.
7. Study and draw sketches of Cut & fill methods
8. Study and draw sketches of Ring hole drilling
9. Study of block caving
10. Coning & quartering methods Study & sketch

### **REFERENCE BOOKS**

- |    |                            |   |                                 |
|----|----------------------------|---|---------------------------------|
| 1. | Elements of mining         | : | LEWS                            |
| 2. | S.M.E Hand Book Vol 1,2,3  |   |                                 |
| 3. | Mining Engineers Hand Book | : | Peele. Vol<br>1,2<br>Arogyaswam |
| 4. | Mining Geology             | : | i                               |
| 5. | Mine Ventilation           | : | G.B.Mishra                      |
| 6. | Rock Mechanics             | : | B.S.Varma.                      |

**Diploma (Semester-VI)  
Mining & Mine Surveying**

**PROJECT WORK**

**COURSE CONTENTS**

Identification of the Project- Collection of data- Organisation of the data- Design of Project elements, Preparation of drawings- Schedules and sequence of operations- Preparation of charts and models Preparation of report

**Note : OBJECTIVES**

- Identify different works to be carried out in the project.
- Collect data relevant to the project.
- Arrive at efficient method from the available choices based on preliminary investigation.
- Design the required elements of the project as per standard practices.
- Prepare working drawing for the project.
- Prepare schedule of time and sequence of operations.
- Prepare charts or models for each project.
- Prepare project report.
- Students shall be divided into groups of five and each group shall be assigned a problem that calls for application of the knowledge. Project work will be allotted by the concerned Head of Section and assign a staff member as guide at the beginning of VI semester. The students are exposed to the U/G workings or Industries for collecting information or relevant data from respective areas during the entire VI semester , to collect information after the institutional working hours or during holidays – second Saturdays / Sundays/ Winter/ holidays and prepares project report under the supervision of guide. Project report will be assessed at the end of VI Semester for final examination. Project may be selected from among the following suggested topics.

**Underground mining(coal )**

- Bord and pillar mining method
- Longwall mining method.
- Blasting gallery method.
- Stopping methods for non-coal mining
- Mechanised stopping methods for non-coal mining

**Opencast mining**

- Pillars extracting by open cast method(coal)
- Mechanised opencast mining.
- In Pit crushing technology
- Surface mining technology
- Blasting technology