Faculty of Engineering & Technology

Study and Evaluation Scheme

Of

Diploma (Engineering)

Diploma (Mining & Mine Surveying Engineering)

(Applicable w.e.f Academic Session 2015-18, till revised)

AKS UNIVERSITY, SATNA

Study and Evaluation Scheme

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# Diploma (Mining & Mine Surveying Engg.)
## (Session-2015)

### Teaching and Examination Scheme Diploma-III

<table>
<thead>
<tr>
<th>S. N.</th>
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### Teaching and Examination Scheme Diploma-IV

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During IV and V semester break for 45 days marks to be awarded in V Semester
Department of Mining Engineering,  
Faculty of Engineering & Technology,  
Diploma (Mining & Mine Surveying Engg.)  
(Session-2015)

Teaching and Examination Scheme Diploma-V

<table>
<thead>
<tr>
<th>S. N.</th>
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Total Credit=28

Teaching and Examination Scheme Diploma-VI

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Total Credit=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 forms 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, crust, back break, angle of repose, , stripping ratio, economic cut of value, quarriable limit, placer mining, alluvial Mining, strip mining, slope stability, back filling. Subgrade drilling, List the major surface coal mines in India, surface metal mines in India. Opening up of deposits: Box cut – objective, types, parameters, methods; Factors affecting selection of box cut site; Production benches – formation, parameters and factors affecting their selection. Statutory provisions for benches, Ramp design. Overcasting, side casting, Pit top and pit bottom layouts, Quality control, Haul Road- design & maintenance, sub grade soil stabilization, width of roadways for various size of dumpers, contact pressures, Culverts, Dump design.

Unit II:
Drilling and blasting techniques in surface mines:Classification of the drill holes, based on depth, diameter and Pattern. 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. Process of blasting, Explosives, Blast design, Bench blasting pattern, Delay blasting (classification), NONEL/Shock tube blasting. Electronic delay use in Indian mines, Powder factor, Calculating explosive requirement in blasting. Problems in blasting, Ground vibration, DGMS norms for blast vibrations, noise, Fly rocks, blasting in hot holes. Explosive van, bulk explosives, ANFO use mechanically, Handling of misfires etc. Different patterns of drill holes employed in mines above. Blasting tools used in open cast mines. Explain the drilling, charging, methods of giving connection and firing procedure in open cast mines. Deck charging or loading and its applicability. Controlled blasting techniques (muffled blasting and cushion blasting) and their applicability Secondary Blasting, methods of secondary blasting pop shooting, mud capping and snake holing and their applicability. List the danger due to blasting practices. List the preventive measures due to blasting practice in open cast mines.

Unit III:
Different Mining machinery (HEMM) employed in surface Mining: Machinery for preparing the ground for mining operation, such as dozer, scraper, road grader, road roller, cranes, Main parts & function of and the place application of Dozer. Main parts, functions, and place of application of road scrapers. Main parts, functions, and place of application of road graders. Main parts, functions, and place of application of excavators/shovels. Main parts, State the function ,and place application of Dumper. Main parts, functions, and place of application of drag lines, BWE, Continuous mining systems (Surface Miner, Highwall mining). Method of working of in-pit crushing technology with case study Applicable conditions, merits and demerits of in-pit crushing technology Applications of GPS in opencast mining.

Unit IV:
Various aspects of surface mining: Slope stability, angle of repose, highwall slope, slope failures (different types), measures to be taken against slope failures, pumping & drainage system, acidic mine drainage, slope mass rating, different techniques and statistical methods
Unit V:


Text Books:
1. A Handbook on Surface Mining Technology : Dr. Samir K Das, Sagardeep Prakashan, Kharagpur
2. Surface Mining : G.B. Misra
3. Mining Machinery : Dr. Khanindra Pathak, Cygnus publisher, 55B Mirza Galib Street, 8th Floor, Saberwal house, Kolkata.
4. Surface Mining : T N Singh, Lovely Prakashan, Dhanbad
5. Advanced Surface Mining : G.K.Pradhan & Manoj Pradhan, MINTECH Publications, Bhubaneswar

Reference Books:
1. Surface Mining: Pfleider
2. Mining Equipment : Boki
3. SME handbook: Hartman
4. Surface mining equipment: Martin
Diploma (Semester-III)
Mining & Mine Surveying
MINING 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 Isostacy.

Unit-II: Physical Geology
Erosion & weathering - Weathering: Physical Weathering and chemical Weathering. Exfoliation and Spheroidal weathering.
River- Erosion, transport and deposition; Waterfalls, meanders, oxbow lakes, alluvial fans, flood plains, delta.
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 in India.
Volcano - Types of volcanoes, volcanic products volcanic cones, Distribution of volcanoes.

Unit-III: Mineralogy

Unit-IV: Petrology
Rock cycle and characteristics of various Rock types. Classification of Igneous Rocks; acid and basic rocks, Plutonic, Hypobyssal and Volcanic rocks. Tabular Classification of Igneous rock. Texture of Igneous rocks.
Sedimentary Rocks - Definition, Classification; Mechanically formed, Organically formed and chemically formed rocks, Sedimentary Structures; Common sedimentary rocks-Conglomerate sandstone, Shale, minestone and breccias.
Metamorphic Rocks - Definition; Agents of Metamorphism,. Structures and textures of metamorphic rocks. Common metamorphic rocks; slate Schist, Gneiss, Quartzite, and marble.

Unit-V: Structural Geology
PRACTICALS (LAB)

1. Megascopic Study and Physical Identification of Rock forming Minerals by their physical properties.
2. Megascopic Study and Physical Identification of Igneous Rock by their physical properties.
3. Megascopic Study and Physical Identification of Sedimentary Rock by their physical properties.
4. Megascopic Study and Physical Identification of Metamorphic Rock by their physical properties.
5. Microscopic Study and Identification of Rock forming Minerals by their Optical properties
6. Microscopic Study and Identification of Igneous Rock by their Optical properties
7. Microscopic Study and Identification of Sedimentary Rock by their Optical properties.
8. Microscopic Study and Identification of Metamorphic Rock by their Optical properties.
9. Draw the outcrop, Dip Strike and profile Section on different kinds of geological structural maps.
10. 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

Reference Books:
1. Structural Geology : M.P. Billings
2. Geological Maps : G.W. Chiplonkar
3. Rutley’s Elements of Mineralogy : H.H. Read
4. Principles Of Petrology : G.W. Tyrell
5. Applied Geology : S. Banger
6. Applied Geology : D.V. Reddy
7. Geology of India (Vol I&II) : R. Vaidyanadhan & M. Ramakrishnan
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) Drills & Drilling for quarrying, opencast and underground mining (coal and non-coal): Types of drills, drilling accessories, drillability of rocks, managing drilling in production mines, dust control during drilling etc.

Unit-II: Explosives

Unit- III: Blasting practices in Mines
Shot-firing tools Preparation of charge Procedure for firing Direct & Indirect consideration of factors Calculation of explosive quantity, powder factor, detonator factor. Solid blasting: Blasting of solids, advantages and disadvantages, precautions and restrictions, pattern of shot holes

Unit- IV: Surface Mine Blasting
Factors affecting blast design, selection of various blast parameters, Burden, Spacing, Stemming distance, Sub grade drilling, depth of hole, bench height, diameter of hole, Different types of explosives used in o/c mines, ANFO, Cartridges (Slurries & Emulsion), Site Mixed Slurry/Emulsion Explosives (or Bulk Explosives) Deck charging and column loading, calculation of charge per hole and powder factor, controlled blasting, special blasting technique. Secondary blasting – Pop shooting and Plaster shooting

Underground Blasting: Various cuts, Burden, spacing, depth of hole, stemming of hole, precaution during blasting. Solid blasting practice

Unit-V : Rock Fragmentation
Mechanism of rock fragmentation, Factors affecting rock fragmentation, Techniques to improve rock fragmentation

Environmental impact of blasting:
Back break, over break, fly rock, blast induced vibration. fumes etc. Ground vibration measurement of other parameters, Prediction & control measures to reduce/check - air blast, noise
Practical
1. Sketch and describe mine inclines top lay out with direct haulage.
2. Sketch and describe about pit top layout.
3. Sketch and describe the different patterns of drilling holes in underground coal mines.
4. Sketch and describe the usual method of drivage of gallery in coal mine showing usual arrangements of pumps, transport (direct rope haulage) and ventilation in dip faces.
5. Sketch and describe different type of exploder.
6. Sketch and describe about the subsitute of explosive such hydrox.
7. Describe with Sketch different type accessories of blasting such as safety fuse, detonecting fuse, circuit tester, nonel, ohm meter.
8. Sketch and describe about surface machgine along with its safety features.
9. Sketch and describe different type of electric detonator.
10. Sketch and describe about drilling machine use in open cast mine.

Text Books
2. B.V. Gokhale, Blasthole drilling Technology, Multi Fields, Bombay
3. Dr G. K. Pradhan, Explosives & Blasting Techniques, Mintech Publications, Bhubaneswar.
4. Dr. Sushil Bhandari, Engineering Rock Blasting Operations. Pub: A. A. Balkema Publisher Old post Road, Brook field, TO5036, USA.
6. Explosive manufacturers' technical literature
8. DGMS Circulars
Diploma (Semester-III)
Mining & Mine Surveying
MINE ENVIRONMENTAL ENGG.

Unit I
Definition, scope and importance, need for public awareness, Natural resources and associated problem. Forest resources: Use and over-exploitation, mining dams and their effects on forest. Water resources: Use and over-utilization of surface and ground water, floods, drought conflicts over water, dams-benefits and problems. Land resources: Land as a resource, land degradation, Soil erosion and desertification.

Unit II
Definition: Cause, effects and control measures of: air pollution, Water Pollution, Marine Pollution, Noise Pollution, Thermal pollution, nuclear hazards, and Solid waste management: Cause, affects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution Case studies, Disaster management: floods, earthquake, cyclone and landslides.

Unit III: Mine Atmosphere
Pollution of mine atmosphere; Mine gases.(CO, Methane); Origin and occurrence of mine gases. Heat and humidity in mine atmosphere and their effects; Cooling power of mine air

Unit IV: Mine Ventilation system & Natural Ventilation
Object and standard of ventilation; Degree of gassiness of mines, composition of mine air; 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; Regulations related with above topics, ecological and environmental laws related to mines.
Dust monitoring; 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, constructional 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’s
1. Determination of relative humidity by whirling hygrometer
2. Determination of cooling power of the mine air by using kata thermometer.
3. Measurement of air velocity, quantity and pressure in a duct by using a pitot tube.
4. Design and Describe air crossing, regulator, Ventilating door, air lock at pit top etc
5. Different gases found in coalmines, metal mines and their permitted limits as per the mining regulations. Effect of these gases when found in excess
6. Designing auxiliary ventilation system and their comparative performance
7. Calculation for the installation of main ventilation fan and its reversal arrangement.
8. Various air circuits with resistance in series and parallel.
9. Ventilation survey problem
10. Air conditioning problem

Text Books

1. Elements of Mining Technology Vol.2, D.J.Deshmukh
2. Mine Ventilation by Prof. S.P.Banerjee
3. Mine Ventilation by Prof. G.B.Mishra
4. Paryavaran Addhyan: KL Tiwari and Jadhav
5. Standard of Lighting Circular. issued by DGMS
Diploma (Semester-III)
Mining & Mine Surveying
MINE SURVEYING- I

Unit I: 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 II: Theodolite-I
PARTS - Terms used - Temporary adjustments - Tachometers. Measurements - such as ranging, establishing new station, horizontal angle, vertical angle, bearings, permanent adjustment.

Theodolite-II
Purpose of traversing first, second and third order traverse, closed closed and open traverse. Included and direct angles, Latitude, Departures, checks-corrections of the traverse- Bowdith rule and transit rule.

Unit III: Dial Survey

Unit IV: Use of level in underground mines
Measuring the depth of shaft and other working, underground bench mark - Datum - determining throw of fault - gradient of underground road. - Measuring subsidence.

Unit V: Dip strike problems
Determining the true and apparent dip and strike from bore hole data, Determining the deviation in the borehole drilling - Determining the throw of fault and length of drift to cross the fault, Finding out the bearings and dip of various mine working.

Text Books

1. Mine Surveying by S. Ghatak
2. Surveying & Levelling by B. C. Punamia
3. Surveying & Levelling by Kanetkar & Kulkarni
LABORATORY EXPERIENCES

1. Theodolite traverses survey.
3. Close traversing by Theodolite & balancing by Bowdith rule & transit rule.
4. Study of Miners Dial its constructional features & adjustments
5. Study of measurement of Depth of a vertical shaft.
6. Determine the true apparent dip & strike from bore hole data.

A. Practices and projects in the field for
- Chain and tape survey - Chain and compass survey - Leveling survey
- Plain table survey
- Use of theodolite in traverse and tachometry - Use of Total Station

B. For all Projects, there is compulsion in presence for Students
- Filling of appropriate tables - Calculations,
- Finding errors
- Error resolving using
  - Graphical and Analytical methods - Preparation of drawing
- Presentation - Binding of all sheets

Efforts will be made to demonstrate the field use of surveying instruments in nearby mines.
Diploma (Semester-IV)
Mining & Mine Surveying

METHOD OF WORK (COAL)

Unit I:
Board and pillar method Development: Board & pillar system , Applicabilities , Merits , Demerits , Different terms , stages of development , depillaring stages , Applicability 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 conveyor load haul dumpers , belt conveyers chain conveyors. Arrangements for ventilation of Road header.

Unit II:
Board 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 , danger and precautions while working below goaved areas , contiguous seams extraction , precautions against fire during and after depillaring.

Unit III:
Long Wall Advancing Method: Long wall , Terminology , Applicabilities , merits , demerits , limitations , classification of Long wall advancing indicating its applicabilities , comparison between Long wall advancing and Long wall retreating , development of gate roads , machinery employed on a mechanized Long wall face continuous mining method , 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 applicabilities , layout of mechanized Long wall face retreating with Stowing , layout of mechanized Long wall face retreating with caving , lay out of Long wall face equipped with shearer , single unit and double unit layouts , cutting methods of the Shearer in longwall mining , methods of sumping in Long wall face extraction , method of push , sumping in longwall face extraction.

Unit V:
Thick seam working: Thick seam Working and associated difficulties different methods and applicabilities , inclined slicing with caving/stowing , Horizontal slicing with caving / stowing , Blasting gallery method sub , level caving with mechanized Long wall , Horizon mining , merits , demerits , Applicabilities limitation of demerits. Applicable condition of a plough , method of working by plough , unidirectional ploughing method , bi-directional ploughing method , overpassing , hydraulic mining , merits and demerits , applicable conditions of underground gasification of coal. Merits , demerits of gasification of coal , method of extraction of gasification and contiguous seam.
Practical:

1) **Know the Drawing of layouts of under ground mine**
   Draw a pit, top & pit Bottom layouts of shaft, layout of Board and pillar showing development work and ventilation network, transport network, layout of Board and pillar showing method depillaring and ventilation network, transport network, layout of longwall mining method locate important areas of working and ventilation network and transportation network, layout of BG panel.

2) **Know the calculation of output for under ground mine**
   Calculate out put for 3 heading, 5 heading faces, Calculate percentage of extraction for Bord and pillar development work assuming the gallery dimensions, Calculate the percentage of extraction for depillaring work, Calculate the percentage of extraction in longwall mining method, Calculate percentage of extraction in Blasting Gallery method, Calculation of Quantity of Explosive require for given out put with reference Bord & Pillar and Blasting Gallery Method.

3) **Know the organisations charts.**
   Draw the Organisations chart for a large Underground Mine, Organisations chart of a Mining Industry.

4) **4.0. Know the method of drawing layouts with Auto Cad**
   Draw the following plans, a) District ventilation plan b) District working plan c) Pit top and pit bottom layouts

**Reference books:**
1. Elements of Mining Technology Vol.I : D.J.Deshmukh
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 : Statham
7. Surface Mining Technology : Samir Kumar Das.
8. Surface Mining : T.N.Singh
Diploma (Engg.)
Mining & Mine Surveying
Semester-IV
Mine Electrical Engineering


Fundamental of transformer 1-Ø, 3-Ø 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, all day efficiency losses in transformer, concept of \( \lambda, \lambda \). Connection of transformer.

Unit-II: Single plane induction motor/working principles 3-Ø. Induction motor (sq. cage/slip-ring).

Double revolving theory, method of starting, \( \frac{x}{A} \) starter, auto transformer starter, Rotor resistance starter, slip, torque, losses, efficiency.

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: Haulage and Coal face signaling systems for underground coal mines, basic concept of underground mine communication.


Practical:
1. To study constructional detail of DC Machine.
2. To obtain Magnetization Characteristics of DC Generator.
3. To study Constructional Detail of Transformer.
4. To obtain load Characteristics and Voltage Regulation of Transformer.
5. No load test of a transformer.
7. No load/load test of a 3-Ø. Induction motor, slip calculation.
8. Study and operation of a single phase motor.
Text Books

1. Nagrath and Kothari. Electrical Machines
2. Ashfaq Hussain. Fundamentals of Electrical Engineering
4. Electrical Engineering in Mines, by N.K. Datta
Diploma (Semester-IV)
Mining & Mine Surveying

MINING LEGISLATION AND GENERAL SAFETY

Unit I:

Unit II:

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
2. Mine Management : V.N.Singh
3. Mines act 1952
5. CMR/MMR 1957 / 61
6. Critical Appraisal : Rakesh & Prasad
7. DGMS Circulars
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/C2 deficiency rations, 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:
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 IV:
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 V: Miners Diseases. Different types of miner’s diseases, diseases due to inhalation of dust in mines causes and preventive measures of pneumoconiosis silicosis, siderosis, manages poisoning, lead poisoning, Chromium poisoning. Harmful effects of ration active minerals-causes and preventive measures of nystagmus and Anky-lostomiosias.
PRACTICALS

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

MINING GEOLOGY-II

Unit I:

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:

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.
PRACTICALS
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
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-I

Unit I:
**Theodolite:** magnetic bearing of lines. Traversing – continuous Azimuth, double foresight 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

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 – Connections applied on base line determination of true north by astronomical observation method of extension 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.

Unit IV:

Unit V:
**Stope Survey**-Objectives – Methods – Tap Triangulation – Field of application – Typing method Radial Ray method – prepare stope sheets – stope plans with details

ADVANCED MINE SURVEYING PRACTICAL
1. **Know the traversing** - Conducts traverse survey by direct bearing method- traverse survey by double foresight method-Plot the traverse by meridian method and rectangular- other types of theodolites.
2. **Know the Triangulation** - Extension of the given base line.
3. **Know the Curve Setting** - Sets out curve by chord and offset-Sets out curve by Chord and Angle.
4. **Know the Tachometry survey** - Determines the tachometric constants- R.L of points by fixed hair method - R.L.s of points by tangential method.
5. **Plotting of various surveying field results** - Plotting of triangulation survey of the given area-Carry out profile levelling survey of the given area and plot its cross section-Carry out subsidence survey on a given area and plot the subsidence profile-Plot the contours of the given area.
6. **Study of the Modern Survey Equipment** - Principle of working of GPS Instrument and draw the diagram- Principle of working of EDM Instrument and draw the diagram- Principle of working of Total Station Instrument and draw the diagram-Carry out survey of a given area with Total station


**TEXT & REFERENCE BOOKS**

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

**PRACTICAL TRAINING AND ASSESSMENT**

**Periods Required:** One and half month during semester break of IVth & Vth

**OBJECTIVES:**

After the completion of these topics the student should be able to

1. Study of History of Mine – Note name of the Owner, Agent, Manager, Safety Office
2. Study of Mine geological information
3. Study of Mine Plans and Sections
4. Study of Surface features related to Mine
5. Study of method of working
6. Study of method of blasting
7. Study of Transportation system and layouts
8. Study of Ventilation systems and layouts
9. Study of Drainage system
10. Study of Pit top and Pit bottom layouts.
11. Study of man Power plan
12. Develop the Lamp room layout and Magazine Layout
13. Draw the charts depicting instructional items related to Mining subjects

**Note:** Students will be sent for practical training to Coal/ Metal mines at the end of IVth & Vth year i.e. during summer vacation to different Mining industries. The training reports/records submitted by the students will be assessed at the end of Vth semester for award of marks

**Reference Books:**

10. Robbins, S. P. and Hunsaker, Phillip, L”” Training in Interpersonal skills””
Diploma (Semester-V)
Mining & Mine Surveying

METAL MINING

Unit - I
Basic concept of Metal Mining and Development of Mineral Deposits

Unit - II
Stooping Methods–Classification of stoping systems, Selecting stoping method Breast stoping, under hand stopping, overhand stoping, open stope stoping. Shrinkage stoping, sub level stoping, vertical crater retreating method. Sublevel slicing, Ring hole drilling, Caving methods.

Unit - III

Unit - IV
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
1. Study of different types of methods adopted in metal mines.
2. Study and draw sketch showing shaft fittings and shaft lay out.
3. Pit bottom and pit top layout around a vertical shaft and inclines.
4. Direct and endless rope haulage study.
5. Study and draw sketches of Breast stoping,
6. Study and draw sketches of under hand stoping,
7. Study and draw sketches of overhand stoping,
8. Study and draw sketches of open stope stoping,
9. Study and draw sketches of Shrinkage stoping,
10. Study and draw sketches of sub level stoping,
11. Study and draw sketches of vertical crater retreating method.
12. Study and draw sketches of Sublevel slicing,
13. Study and draw sketches of Ring hole drilling
14. Study and draw sketches of air-leg drill used in metal mines.
15. Study of block caving
16. Study & sketch of different sampling methods
**REFERENCE BOOKS**

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<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Author</th>
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<tbody>
<tr>
<td>1.</td>
<td>Elements of mining</td>
<td>LEWS</td>
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<td>2.</td>
<td>S.M.E Hand Book Vol 1,2,3</td>
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<td>3.</td>
<td>Mining Engineers Hand Book</td>
<td>Peele. Vol 1,2</td>
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<td>4.</td>
<td>Mining Geology</td>
<td>Arogyaswami</td>
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<td>5.</td>
<td>Mine Ventilation</td>
<td>G.B.Mishra</td>
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Diploma (Semester-V)
Mining & Mine Surveying

MINING MACHINERY – I

Unit I:

Unit II:

Unit III:

Unit IV:
Transportation in Mines -Conveyors Conveyor usage, classification - belt conveyor system, different types of belt constructions, safety devices merits, demerits and limitations of Best conveying system - compilation of numerical problems to find the material quantity H.P. length and inclination of haulage, tensing strength breaking strength of belt amount of slip. Scraper chain convey or system, protective devices-merits, demerits and limitation. Transportation in Mines - Locomotives & Areal rope ways -Clarifies loco haulage systems, merits, demerits, explicabilities of different system – clarifies aerial roper ways, the applicable conditions of aerial ropeways.

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. Introduction to Mining, G.K.Pradhan, Mintech Publications, Bhubaneswar
Practical:

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 Arial 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
Diploma (Semester-V)
Mining & Mine Surveying

Advanced Mine Surveying-II

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.


Unit-II
Subsidence Survey: Subsidence monitoring, data required for subsidence studies, parameter required during monitoring, layout of survey lines, survey station, measurement technique and instrumentation, measurement of displacement slope and subsurface movement, frequency of subsidence measurement.

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.

Unit-IV
Application of Automation & IT in surveying: Data acquisitions; Preparation of plans and sections; Calculation of earth works, Introduction to Surveying software’s, Application of GIS and Remote Sensing in mine Surveying.

Development Surveys: Control of direction and gradient in drifts, tunnels, raises, winzes.

Unit-V
Shaft Surveying: Determination of depth of shaft, method of checking verticality of shaft, surveying of installation like winding pulley, winding drum, head gear, fleet angle and their concept.


Practical’s:

1. Exercise on tacheometric contouring and plotting of contour map.
2. Calculation of area of map with the help of planimeter.
3. Application of GIS software in mine surveying.
4. Exercise related to pentagraph.
5. Study of contour map and toposheets.
6. Determination of depth of shaft and its verticality.
Diploma (Semester-V)
Mining & Mine Surveying

ROCK MECHANICS AND STRATA CONTROL

Unit I:
**Introduction:** Definition of rock mechanics – scope of Rock mechanics Application of Rock mechanics to mining field.

Unit II:
**Ground Forces, Stress Analysis, Stress distribution in underground:** Various forces acting on block – types of Stress – Relation between vertical and lateral stresses – Stress field – Hydrostatic and Lithostatic 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:

Unit IV:
**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.

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

Unit V:

**Practical**
1. Procedure for the determination of compressive strength and point load index of given rock samples.
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

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.
Diploma (Semester-V)
Mining & Mine Surveying

Mining Hazards & Safety I

Unit-I:

Unit-II: Mine-explosions:

**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
3. Hand book on First Aid, Published by Multi Disciplinary Centre on Safety, Health & Environment, Bhubaneswar
Diploma (Semester-VI)
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 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
Composition of safety committee, function of safety committee work men inspector, duty of work- men inspector, provision of canteen, accident to mine rescue brigade member, Rescue chamber, refuge station or refuge bay, barricades.

Unit V
A. Important regulation of CMR 1957 such as CMR 31A,32,32A,33,35,83,87,99,100,104,105,107,108,113, 136A,142, 143
B. Indian electricity rule
Practicals:
1. Study of constructional features & working of self contained breathing apparatus.
2. Study of various types of Fire Extinguishers used in Mines.
4. Study of constructional features & working of Gas Mask.
5. Study of constructional features & working of Reviving apparatus.
7. Study of constructional features & working of Stone Dust Barriers.
8. First aid training to be explained and conducted.
10. Emergency organization in underground mines.

Text & Reference Books:
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
Hand book on First Aid, Published by Multi Disciplinary Centre on Safety, Health & Environment, Bhubaneswar
Diploma (Semester-VI)
Mining & Mine Surveying

MINE MANAGEMENT AND MINERAL ECONOMIC

Unit I:
**Mine management:** Role of mining Industry in country’s economic development, ownerships of Industries, Management, organisation, in the context of mining Industry.

Unit II:
**Entrepreneurship:** Motivating factors, Risks and Rewards, requirements self employment schemes, products selection, site solution, plant layout, setting of a mine, Market survey. Feasibility report, Man Power requirement, techno-economic and cost factors.

Unit III
**Work Study** - work study, principle of workstudy, scope and necessity of workstudy, Method study, advantages of Method study, time study, principle of time study.

Unit IV:
**Industrial Dispute Act-1947:** Industrial Dispute act-1947, causes for Industrial Dispute adverse effects for Industrial Dispute various provisions of ID act works committee, conciliation officer, Bord of conciliation court of enquiry, industrial tribunal, voluntary organisation, strike and lockout.

Unit V:
**Total Quality and Management:** Concepts of Quality and its use in mine production.

Text & Reference Books
2. Mine Management : V.N.Singh
3. Industrial Management : O.P.Khanna
4. Industrial Management : Jain and Bhanu
5. Mines act 1952
7. CMR/MMR 1957 / 61
8. Critical Appraisal : Rakesh & Prasad
10. Encyclopaedia of Mining Laws
11. Mine safety and disaster : C.P.Singh
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 - Sub-station 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:

Text & Reference Books
1. UMS
2. Mine Electrical By N.K. Dutta
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:

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

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 CONTRUCTION.
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
Unit I.
MINE SAMPLING: Definition, terms, purpose and various uses. Different sampling methods. Salting—purpose, safety against salting. Reduction of sampling—Methods used.

Unit II:
ASSAYING: Introduction - assay map, assay plan factor, assay values, grade value, tenar, type of grade value. Calculations based on average assay value. Estimation of ore reserves.

Unit III.

Unit IV:
COAL PROCESSING/BENEFICIATION: 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 improvement while mining, Coal handling, Dry coal beneficiation, Wet coal beneficiation, National Mineral Policy.

PRACTICAL
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 flotation.
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. Mine economics Sinha & Sharma
3. Element of mining D.J.Deshmukh
4. U.M.S.
5. Mine economics A.Kumar
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.
- Stoping methods for non-coal mining
- Mechanised stoping 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