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

Syllabus
of

## Diploma in Mining Engineering [MIN]

Part-III (5th Semester)

Revised 2022

## Detailed Curriculum Contents for Diploma in Mining Engineering

## SEMESTER V

| Sl. No | Category | Code No. | Course Title | Hours per week | | | Total contact hrs/ week | Credits | Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | | |
| 1. | Program core course | MINPC 501 | Mine Management & Legislation | 3 | 0 | 0 | 3 | 3 | 100 |
| 2. | Program core course | MINPC 502 | Mine Hazards-I | 3 | 0 | 0 | 3 | 3 | 100 |
| 3. | Program core course | MINPC 503 | Mechanical Engineering in Mining | 2 | 0 | 0 | 2 | 2 | 100 |
| 4. | Program core course | MINPC 511 | Mine Safety Lab. | 0 | 0 | 2 | 2 | 1 | 100 |
| 5. | Program core course | MINPC 512 | Mechanical Engineering in Mining Lab. | 0 | 0 | 2 | 2 | 1 | 100 |
| 6. | Program core course | MINPC 513 | Computer Aided Design & Drafting Lab. | 0 | 0 | 2 | 2 | 1 | 100 |
| 7. | Program elective course | MINPE 52* | Elective-II | 3 | 0 | 0 | 3 | 3 | 100 |
| a. | ANY ONE COURSE HAS TO BE TAKEN FROM a & b | MINPE 521 | Mine Survey-II | | | | | | |
| b. | | MINPE 522 | Introduction to Petroleum & Natural Gas Engineering | | | | | | |
| 8. | Program elective course | MINPE 52* | Elective-III | 3 | 0 | 0 | 3 | 3 | 100 |
| c. | ANY ONE COURSE HAS TO BE TAKEN FROM c & d | MINPE 523 | Modern Mine Machinery | | | | | | |
| d. | | MINPE 524 | Mineral Dressing | | | | | | |
| 9. | Internship-II after Semester IV | MINSI 541 | | 0 | 0 | 0 | 0 | 1 | 100 |
| 10. | Major Project | MINPR 551 | | 0 | 0 | 4 | 4 | 2 | 100 |
| | TOTAL | | | | | | 24 | 20 | 1000 |

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

| | | |
|---|---|---|
| Course Code | : | MINPC 501 |
| Course Title | : | Mine Management & Legislation |
| Number of Credits | : | 3 (L : 3, T : 0, P : 0) |
| Prerequisites | : | Elementary knowledge of Mining Operations |
| Course Category | : | PC |

**TOPIC WISE DISTRIBUTION OF THE COURSE:**

| UNIT | TOPIC | LECTURE PERIODS | TUTORIAL PERIODS |
|---|---|---|---|
| I | **Basic Management Concepts** | 6 | 0 |
| II | **Production Management** | 6 | 0 |
| III | **Human Resources Management (HRM) in Mining** | 9 | 0 |
| IV | **Mines Act, 1952 & Mines Rules, 1955** | 3 | 0 |
| V | **Coal Mines Regulation, 2017 & Metalliferous Mines Regulations, 1961- PRELIMINARY, RETURNS, NOTICES AND RECORDS, DUTIES AND RESPONSIBILITIES OF OFFICIALS, COMPETENT PERSONS AND WORKMEN** | 6 | 0 |
| VI | **Coal Mines Regulation, 2017 & Metalliferous Mines Regulations, 1961- PLANS AND SECTIONS, WINDING IN SHAFTS, HAULAGE** | 9 | 0 |
| VII | **Coal Mines Regulation, 2017 & Metalliferous Mines Regulations, 1961- MINE WORKINGS** | 6 | 0 |

**Course Objectives:**

Following are the objective of this course:

- To have basic concepts of management and organisations.
- To have an introductory idea about production management.
- To have fundamental concepts of Human Resources Management in mining.
- To understand the main provisions of the Mines Act, 1952 and the Mines Rules, 1955.
- To understand the preliminary, notices and duties and responsibilities of officials, competent persons & workmen as per the CMR, 2017 & MMR, 1961.
- To understand the statutory provisions regarding plans and sections, winding in shafts and haulage as per the CMR, 2017 & MMR, 1961.
- To understand the statutory provisions regarding mine workings as per the CMR, 2017 & MMR, 1961.

**Course Content:**

**UNIT-I Basic Management Concepts**

- Management - Definition, Evolution in brief & Functions of management- brief discussion on Planning, Organising, Coordinating, Motivating, Directing & Controlling;
- Scientific management - F.W. Taylor's contribution towards scientific management;
- Management principles by Henry Fayol ( Elementary concepts only)
- Organisation: Different structures- Line, Staff and Line & Staff Organisations- merits and demerits of each type
- Structure of organisation for Mining enterprises- Underground Mines and Surface Mines

**UNIT-II Production Management**

- Production Planning, Scheduling & Control; Basic concepts of short time & long term planning
- Work study – meanings of the terms Method study and Work measurement; Basic concepts and procedures and advantages.
- Network analysis- Programme Evaluation & Review Technique (PERT) & Critical Path Method (CPM )- Basic concepts; Advantages of network analysis; Different terminologies like activity, dummy or redundant activity, precedent activity, concurrent activity, subsequent activity, successor, predecessor, merge, burst events, earliest expected time, least allowable time, optimistic time , likely time, pessimistic time; Rules for drawing networks; Steps for critical path analysis; Application of critical path analysis.

**UNIT-III Human Resources Management (HRM) in Mining**

- Importance of Human Relations in the Mining Sector; Industrial Psychology; Effects of bad morale; Measures of improving human relations
- Personnel Management – Objectives - Selection, Training & Development of human resources; Conflict; Dealing with Conflict

- Absenteeism – Causes of absenteeism among mine workers; Effects and mitigating measures to be taken
- Wages and Incentives- Definitions, Essentials of a good wage system; Different components of wages; Different methods of wage payments – merits and demerits of each system; Factors influencing success of incentive schemes.
- Industrial leadership – Characteristics required for leadership; Leadership styles- Autocratic, Democratic & Free rein leaderships- basic concepts; Concept of Motivation; Different motivating techniques- brief ideas only.

**UNIT-IV Mines Act, 1952 & Mines Rules, 1955**

- Mines Act, 1952- Definitions; Hours and Limitation of Employment; Leave with Wages.
- Mines Rules '55- Chapter- I: Preliminary; Chapter- IVA: Medical Examination of Persons Employed; Chapter- V: Health & Sanitation Provisions;
- Mines Rules '55- Chapter- VI: First Aid and Medical Appliances; Chapter- VII: Employment of Persons; Chapter- VIII: Leave with Wages & Overtime; Chapter- IX: Welfare Amenities

**UNIT-V Coal Mines Regulation, 2007 & Metalliferous Mines Regulations, 1961- PRELIMINARY, RETURNS, NOTICES AND RECORDS, DUTIES AND RESPONSIBILITIES OF OFFICIALS, COMPETENT PERSONS AND WORKMEN**

- Definitions; Notice of opening; Notice of abandonment, closure or discontinuance; Notice of reopening; Notice of dangerous occurrence or accident; Notice of disease
- Duties of person employed in mines; Duties of competent person; Duties of officials; Duties and responsibilities of overman; Duties and responsibilities of sirdar; Duties and responsibilities of shot firer; Duties of support man; Duties and responsibilities of surveyor

**UNIT-VI Coal Mines Regulation, 2007 & Metalliferous Mines Regulations, 1961- PLANS AND SECTIONS, WINDING IN SHAFTS, HAULAGE**

- Regulations on Plans and Sections;
- Regulations on Winding in Shafts;
- Regulations on Haulage.

**UNIT-VII Coal Mines Regulation, 2007 & Metalliferous Mines Regulations, 1961- MINE WORKINGS**

- Regulations on mine workings

**Suggested learning resources:**

1. Mine Management Legislation & General Safety by S Ghatak

2. Mine Management Legislation & General Safety by L C Kaku
3. Mines Act by L.C. Kaku
4. Mines Rules 1955
5. Coal Mines Regulations 2017
6. Metalliferous Mines Regulations, 1961
7. DGMS Orders & Circulars
8. PRASAD and RAKESH : Legislation in Indian Mines: A Critical Appraisal – Vol. I & Vol. II
9. www.dgms.gov.in

**Course outcomes:**

After completing this course, student will be able to:

- Understand basic concepts of management and organisations.
- Know how a production unit functions and device mechanism to improve it.
- Have fundamental concepts of Human Resources Management in mining.
- Apply the main provisions of the Mines Act, 1952 and Mines Rules, 1955 in mines.
- Apply the knowledge of preliminary, notices and duties and responsibilities of officials, competent persons & workmen as per the CMR, 2017 & MMR, 1961 in the mines.
- Apply the provisions regarding plans and sections, winding in shafts and haulage as per the CMR, 2017 & MMR, 1961 in mines.
- Apply the provisions regarding mine workings as per the CMR, 2017 & MMR, 1961 in mines.

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|---|---|---|
| Course Code | : | MINPC 502 |
| Course Title | : | Mine Hazards- I |
| Number of Credits | : | 3 (L : 3, T : 0, P : 0) |
| Prerequisites | : | Elementary knowledge of Mining Operations |
| Course Category | : | PC |

**TOPIC WISE DISTRIBUTION OF THE COURSE:**

| UNIT | TOPIC | LECTURE PERIODS | TUTORIAL PERIODS |
|---|---|---|---|
| I | **Mine Fires** | 9 | 0 |

| | | | |
|---|---|---|---|
| II | **Dealing with underground and surface mine fires** | 9 | 0 |
| III | **Firedamp explosion** | 6 | 0 |
| IV | **Coal dust explosion** | 9 | 0 |
| V | **INUNDATION** | 12 | 0 |

**Course Objectives:**

Following are the objective of this course:

- To learn about Mine Fires and detection of spontaneous heating in early stages.
- To know the methods of dealing with mine fires.
- To learn about firedamp explosions in underground coal mines and preventive measures to be taken for the same.
- To learn about the coal dust explosion in underground coal mines and preventive measures to be taken for the same.
- To learn about inundation of mines and preventive measures to be taken for the same.

**Course Content:**

**Unit- I : Mine Fires**

- Fires – Conditions, Open fires: due to Electricity– Friction- Open lights- Blasting - other causes; Preventive measures.
- Fire due to spontaneous heating: Conditions; Crossing point temperature; Incubation period; factors governing spontaneous heating; Symptoms of spontaneous heating in underground mines; CO formed / Oxygen absorbed ratio and its interpretation; preventive measures against spontaneous heating.

**Unit- II : Dealing with underground and surface mine fires**

- Immediate steps to be taken after break out of fire; direct method of dealing fire with water, sand or with other suitable fire extinguishers;
- Construction and purpose of temporary stopping and permanent stopping; Fittings provided in Stoppings; Sealing off a fire area; Pressure balancing;
- Intentional flooding: Flooding the fire area or the mine;
- Dealing with fires in coal pillars and in coal stacks;
- Different types of fire extinguishers.

**Unit – III: Firedamp explosion**

- Firedamp explosion in underground mine: Conditions, Explosive mixture (Limits of explosibility); various influencing factors.
- Le Chatelier Equation; Coward's diagram and its significance, Ignition temperature, Lag on Ignition
- Causes of firedamp explosion, preventive measures

**Unit – IV: Coal dust explosion**

- Coal dust explosion: Conditions, limits of explosibility (inflammability), causes, factors affecting explosibility (inflammability) of coal dust and prevention of coal dust explosion.
- Treatment with incombustible dust and water in every part of a mine ( not naturally wet throughout or not isolated by explosion proof stoppings), Sampling procedure of roadway mine dust;
- Stone dust barriers, water barriers, and triggered barrier

**Unit – V: INUNDATION**

- Causes of inundation from surface water and preventive measures;
- Causes of inundation from underground water and preventive measures;
- Causes of inundation in opencast mines and preventive measures;
- Water dams: calculation of thickness of dam, construction;
- Approaching water logged workings, long-hole boring by burn side boring apparatus.

**Suggested learning resources:**

1. D.J. Deshmukh: Elements of Mining Technology Vol. 2.
2. PRASAD and RAKESH : Legislation in Indian Mines: A Critical Appraisal – Volume II
3. S. Ghatak : A Study of Mine Management, Legislation and General Safety
4. C.M.R -2017
5. DGMS Orders & Circulars

**Course outcomes:**

**After completing this course, student will be able to:**

- apply the acquired knowledge to take precautionary measures against occurrence of fire in mines and detect spontaneous heating in early stages.
- apply the acquired knowledge to deal with mine fires with safety.
- take necessary precautions against firedamp explosions in an underground coal mine.
- take necessary precautions against coal dust explosions in an underground coal mine.
- take necessary precautions against inundation of mines from surface and underground water.

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|---|---|---|
| Course Code | : | MINPC 503 |
| Course Title | : | Mechanical Engineering in Mining |
| Number of Credits | : | 2 (L : 2, T : 0, P : 0) |
| Prerequisites | : | Basic knowledge in Mathematics, Physics, Engineering Mechanics |
| Course Category | : | PC |

**TOPIC WISE DISTRIBUTION OF THE COURSE:**

| UNIT | TOPIC | LECTURE PERIODS | TUTORIAL PERIODS |
|---|---|---|---|
| I | **Stress & Strain** | 2 | 0 |
| II | **Steam & Boiler** | 6 | 0 |
| III | **Fundamentals of I.C. Engine** | 4 | 0 |
| IV | **Air Compressor** | 4 | 0 |
| V | **Fluid Mechanics** | 8 | 0 |
| VI | **Pumps** | 6 | 0 |

**Course Objectives:**

Following are the objectives of this course:

- To know about stress & strain.
- To have fundamental ideas on steam properties and steam generators.
- To become familiar with the fundamentals of I.C. Engines.
- To know about the Air Compressors and their uses.
- To have fundamental knowledge on fluid properties and flow measurement.
- To understand the workings of Centrifugal & Reciprocating pumps.

**Course Content:**

**Unit- I : Stress & Strain**

- Definitions and Classification of stress & strain, Poisson's ratio, Hook's law, Elastic constants & relationship among them (deduction not required, only simple numerical).
- Stress-Strain diagram (Mild steel only)- Elastic limit, yield point, ultimate strength, breaking point, working stress, factor of safety.

**Unit-II : Steam & Boiler**

- Heat and temperature, properties of steam, sensible heat, latent heat of vaporisation, wet, dry and superheated steam; enthalpy of steam, critical point, triple point, dryness fraction, degree of superheat, P-H diagram of steam.
- Functions of boilers and their classification, Fire tube & water tube boilers with example, working principle, difference and applications.
- Brief description and working principles only of the following boilers: Cochran, Lancashire and Babcock Wilcox.
- Definition of boiler mountings and accessories, Functions of boiler mountings and important boiler accessories.

**Unit-III : Fundamentals of I.C Engine**

- Definition & Classification of I.C. Engines. Working Principle, Construction with function of components of IC Engines and Comparison of Two-Stroke and Four-Stroke (Petrol and Diesel) Engines.
- Hypothetical & Actual Indicator Diagram of Two-Stroke and Four-Stroke (Petrol and Diesel) Engines, and Thermal Efficiency of four stroke, Otto Cycle and Diesel Cycle. (No Deductions-numericals).

**Unit-IV : Air Compressor**

- Definition, Uses of Compressed Air, Classification of Air Compressors.
- Definition of Compression Ratio, Compressor Capacity, Free Air Delivery and Swept volume.
- Construction and Working Principle of Single Stage reciprocating air compressor, work done.
- Multistage compressors, intercoolers and after coolers.
- Compressors air transmission and losses in transmission and storage, use of compressed air in mines.

**Unit-V : Fluid Mechanics**

- Fluid & its properties-
    - Fluid- types of fluid, ideal & real fluids, Newtonian, dilatant, pseudoplastic, ideal plastic, rheopectic, thixotropic fluids, Rheological diagram.
    - Fluid Density, Specific gravity, Specific Weight, Specific Volume, Dynamic Viscosity, Kinematics Viscosity, Cohesion & Adhesion, Surface tension, Capillarity, Vapour Pressure, Compressibility.

- Fluid Pressure & Pressure Measurement-
    - Fluid pressure head, Pressure intensity, Pascal's law and its application (simple numericals only).
    - Concept of absolute vacuum, gauge pressure, atmospheric pressure, absolute pressure.
    - Piezometer tube, Simple and differential manometers, Bourdon tube pressure gauge (no numerical).

**Unit-VI: Pumps**

- Definition of pump, Classification of pumps.
- Centrifugal Pumps-
    - Construction , principle of working and applications
    - Concept of multistage
    - Priming, Cavitation
    - Manometric head, Work done, Manometric efficiency, Overall efficiency, NPSH
    - Characteristic curves of Centrifugal pump.

  Note- No Derivations and Numericals on centrifugal pump.

- Reciprocating Pump-
    - Construction, working principle and applications of single and double acting reciprocating pumps.
    - Concept of Slip, Negative slip, Cavitation and separation
    - Use of Air Vessel, Ideal Indicator diagram, comparison between centrifugal and reciprocating pump.

  Note:- No Derivations and Numericals on reciprocating pumps

**Suggested learning resources:**


1. Strength of Materials by R.S.Khurmi, S.Chand & Co.
2. A Course in Thermal Engineering by R.S. Khurmi, S. Chand & Co.
3. Engineering Thermodynamics (Principles & Practices) by D.S.Kumar, S.K. Kataria &. Sons
4. A Textbook of Thermal Engineering by V.M. Domkundwar, DhanpatRai & Co.
5. Fluid Mechanics & Hydraulic machines by D.S.Kumar, S.K.Kataria
6. Fluid Mechanics & Hydraulic machines by R.D.Bansal, Laxmi Publication
7. Fluid Mechanics & Hydraulic machines by S.Pati, Tata McGraw Hill


**Course outcomes:**

After completing this course, student will be able to:

- Demonstrate different types of stresses induced on components under different loading conditions.
- Understand the formation and properties of steam.

- Understand the working of different types of boilers and the necessity of boiler mountings & accessories.
- Supervise different operations in mines utilising compressed air.
- Supervise operations of different equipment in mines having four-stroke & two-stroke Petrol and Diesel Engine.
- Understand the basics of fluid mechanics and flow measurement.
- Supervise the operation of different types of pumps in mines.

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|---|---|---|
| Course Code | : | MINPC 511 |
| Course Title | : | Mine Safety Lab |
| Number of Credits | : | 1 (L : 0, T : 0, P : 2) |
| Prerequisites | : | Elementary knowledge of Mining Operations |
| Course Category | : | PC |

**Course Objectives**:

Following are the objective of this course:

- To be familiar with fire stopping, stone dust barrier, fire extinguishers and water dam.
- To be familiar with different rescue apparatus and cap lamps.

**List of practicals to be performed:**

| | |
|---|---|
| 1. | Study and sketch of fire stopping with fittings. |
| 2. | Study and sketch of Stone Dust Barriers. |
| 3. | Study and sketch of different fire extinguishers. |
| 4. | Study and sketch of brick and cement concrete dams. |
| 5. | Study and sketch of different Rescue apparatus. |
| 6. | Study and sketch of Cap lamp and charging system. |

**Course outcomes:**

After completing this course, student will able to:

- Understand the constructional procedure of Fire stopping, Stone Dust Barrier and water dam.
- Take decisions regarding application of different fire extinguishers in different situations.
- Apply his acquired knowledge while using some rescue apparatus in different situations.
- Understand the constructional features of Cap lamp with charging system.

**Suggested learning resources:**

1. D. J. Deshmukh: Elements of Mining Technology Vol. 2.
2. S. Ghatak: A Study of Mine Management, Legislation and General Safety
3. DGMS Orders & Circulars

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| | | |
|---|---|---|
| Course Code | : | MINPC 512 |
| Course Title | : | Mechanical Engineering in Mining Lab. |
| Number of Credits | : | 1 (L : 0, T : 0, P : 2) |
| Prerequisites | : | Basic knowledge in Physics, Chemistry & Engineering Mechanics |
| Course Category | : | PC |

**Course Objectives**:

Following are the objective of this course:

- To become familiar with the construction, principle of operation, characteristics & uses of different types of boilers.
- To learn about the function of boiler mountings and accessories.
- To have an idea about working of four-stroke & two-stroke Petrol and Diesel Engines.
- To have an idea about working of a single stage reciprocating air compressor.
- To understand the working principles of centrifugal pump and reciprocating pump.

**List of practical to be performed: (<u>Any Six</u>)**

| | |
|---|---|
| 1 | Study of Cochran Boiler (fire tube boiler) |
| 2 | Study of Lancashire Boilers (fire tube boiler) |

| | |
|---|---|
| 3 | Study of Babcock and Wilcox Boiler (water tube boiler) |
| 4 | Study the boiler mountings and accessories |
| 5 | Study of (four-stroke & two-stroke) Petrol and Diesel Engine. |
| 6 | Study the working principle of a single stage reciprocating air compressor using a cut section model and identify different components of it. |
| 7 | Study the working principle of centrifugal pump |
| 8 | Study the working principle of reciprocating pump |

**Suggested learning resources:**

1. Thermal Engineering (Heat Power) by A.R Basu, Dhanpat Rai & Co.
2. A Course in Thermal Engineering by R.S. Khurmi, S. Chand & Co
3. Engineering Thermodynamics (Principles & Practices) by D.S.Kumar, S.K. Kataria & Sons
4. A textbook of Thermal Engineering by V.M. Domkundwar, Dhanpat Rai & Co.
5. Fluid Mechanics & Hydraulic machines by D.S.Kumar, S.K.Kataria
6. Fluid Mechanics & Hydraulic machines by R.D.Bansal, Laxmi Publication
7. Fluid Mechanics & Hydraulic machines by S.Pati, Tata McGraw Hill

**Course outcomes:**

After completing this course, student will be able to:

- Apply the acquired basic knowledge of different types of boilers in the mining sector.
- Supervise operations of different equipment in mines having four-stroke & two-stroke Petrol and Diesel Engine.
- Supervise different operations in mines utilising compressed air.
- Supervise the workings of different types of pumps in mines.

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| | | |
|---|---|---|
| Course Code | : | MINPC 513 |
| Course Title | : | Computer Aided Design & Drafting lab |
| Number of Credits | : | 1 (L : 0, T : 0, P : 2) |
| Prerequisites | : | Elementary knowledge of computer environment and Engineering Graphics |
| Course Category | : | PC |

**Course Objectives:**

Following are the objective of this course:

- To acquire basic knowledge about the application of Computer aided design & Work with drawing software
- To be familiar with different terms, commands and methodologies of the software.
- Make a drawing, create text, giving dimensions to a drawing, hatch patterns and make & insert symbols.
- To develop skills in drawing diagrams, plans etc.
- To develop interest in the field of planning & designing.
- To apply the skill of designing & drafting in the field of Mining.

**List of practicals to be performed:**

| | |
|---|---|
| 1 | GETTING STARTED – II<br>Starting AutoCAD – AutoCAD screen components – Starting a drawing: Open drawings, Create drawings (Start from scratch, Use a template & Use a wizard) – Invoking commands in AutoCAD |
| 2 | Drawing lines in AutoCAD – Coordinate systems: Absolute coordinate system, Relative coordinate system – Direct distance method – Saving a drawing: Save & Save As – Closing a drawing – Quitting AutoCAD |
| 3 | GETTING STARTED – IIII<br>Opening an existing file – Concept of Object – Object selection methods: Pick by box, Window selection, Crossing Selection, All, Fence, Last, Previous, Add, Remove – Erasing objects |
| 4 | OOPS command, UNDO / REDO commands – ZOOM command – PAN command, Panning in real time – Setting units – Object snap, running object snap mode – Drawing circles |
| 5 | DRAW COMMANDS<br>ARC command – RECTANG command – ELLIPSE command, elliptical arc – POLYGON command (regular polygon) – PLINE command – DONUT command – POINT command –<br>Construction Line: XLINE command, RAY command – MULTILINE command |
| 6 | EDITING COMMANDS<br>MOVE command – COPY command – OFFSET command – ROTATE command – SCALE<br>command – STRETCH command – LENGTHEN command |
| 7 | TRIM command – EXTEND command – BREAK command – CHAMFER command – FILLET command – ARRAY command – MIRROR command |

| | |
|---|---|
| 8 | MEASURE command – DIVIDE command – EXPLODE command – MATCHPROP command – Editing with grips: PEDIT |
| 9 | DRAWING AIDS<br>Layers – Layer Properties Manager dialog box – Object Properties: Object property toolbar, Properties Window – LTSCALE Factor – Auto Tracking – REDRAW command, REGEN command |
| 10 | CREATING TEXT<br>Creating single line text – Drawing special characters – Creating multiline text – Editing text – Text style |
| 11 | Fundamental dimensioning terms: Dimension lines, dimension text, arrowheads, extension lines, leaders, centre marks and centrelines, alternate units – Associative dimensions – Dimensioning methods – Drawing leader |
| 12 | BASIC DIMENSIONING INQUIRY COMMANDS<br>AREA – DIST – ID – LIST – DBLIST – STATUS – DWGPROPS |
| 13 | HATCHING<br>BHATCH, HATCH commands – Boundary Hatch Options: Quick tab, Advance tab – Hatching around Text, Traces, Attributes, Shapes and Solids – Editing Hatch Boundary –BOUNDARY command. |
| 14 | PLOTTING DRAWINGS IN AUTOCAD<br>PLOT command – Plot Configuration – Pen Assignments – Paper Size & Orientation Area – Plot Rotation & Origin – Plotting Area – Scale |
| 15 | Practice Drawing : Orthographic projection of an object/ block |

**Suggested learning resources:**

1. Beginning AutoCAD, Exercise workbook, Cheryl R. Shrock (Autodesk authorised author), BPB Publication
2. AutoCAD 2019, Vishnu Priya Singh, Asian Publishers
3. AutoCAD 2018, Training guide, Linkkan Sagar, BPB Publication

**Course outcomes:**

After completing this course, student will be able to solve two dimensional drafting and design problems by being able to use AutoCAD commands to:

1. to make a drawing
2. create text
3. dimension a drawing

4. hatch patterns
5. make & insert symbols
6. plot drawings

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|---|---|---|
| Course Code | : | MINPE 521 |
| Course Title | : | Mine Survey- II |
| Number of Credits | : | 3 (L : 3, T : 0, P : 0) |
| Prerequisites | : | Basic knowledge in Mathematics & Engineering Graphics |
| Course Category | : | PE |

**TOPIC WISE DISTRIBUTION OF THE COURSE:**

| UNIT | TOPIC | LECTURE PERIODS | TUTORIAL PERIODS |
|---|---|---|---|
| I | **Tacheometry** | 6 | 0 |
| II | **Dial Survey** | 9 | 0 |
| III | **Correlation of surface survey and underground survey** | 6 | 0 |
| IV | **Curve setting** | 6 | 0 |
| V | **Mine Triangulation (plane triangle only)** | 6 | 0 |
| VI | **Introduction to Subsidence Survey & Stope Survey** | 3 | 0 |
| VII | **Dip & Fault Problem and Volume Calculation** | 9 | 0 |

**Course Objectives:**

Following are the objectives of this course:

- To learn to conduct Tachometric surveys for various cases.
- To learn to conduct dial surveying in mines to prepare plans.
- To know about the correlation of surface survey and underground survey.

- To understand various curve setting techniques used in mines.
- To know about mine triangulation by plane triangles.
- To have introductory ideas on subsidence surveys and stope surveys.
- To solve numerical problems related to Dip, Strike, Drift etc. of a seam or orebody and calculate volume of a coal heap.

**Course Content:**

**Unit- I Tacheometry:**

- Tacheometry and its various types and their accessories- its application.
- Derivation of formula for horizontal distances and reduced levels.
- Stadia tacheometry, tangential tacheometry, subtense bar tacheometry, Beman's stadia arc.
- Numerical examples in tacheometry.

**Unit- II Dial Survey**

- Meridians, magnetic needle, magnetic dip, isogenic lines, Agonic lines, Isoclinic & Aclinic lines, Variations of magnetic declination.
- Whole circle bearing, Quadrant bearing, Magnetic bearing, True bearing, Azimuth, Fore bearing, Back bearing.
- Converting magnetic bearing to true bearing and vice versa, laying down magnetic meridian on an old Plan, computations of angles from bearings and bearings from angles and related problems.
- Traversing by dial: closed traverse, open traverse.
- Fixed needle traversing - continuous azimuth method or meridian baseline method, double fore sight method, back and fore sight method.
- Advantages and disadvantages of different methods.
- Method of booking, plotting by protector, sources of error in dial survey traversing- limits of errors.
- Different types of verniers, verniers used in dial.
- Miner's Dial: Loose needle surveying with a miner's dial in presence of local attraction.
- Prismatic compass- difference between prismatic compass and miners dial.

**Unit- III Correlation of surface survey and underground survey**

- Definition and purpose of mine correlation
- Control of direction through incline and shaft, shaft depth measurements – only enumeration of different types
- Methods of correlation: two shaft method, single shaft method (alignment method, weisbach triangle method, Weiss quadrilateral method)
- Modern methods: gyroscopic method of correlation- introduction, by Autoplumb and Laser (to impart ideas).

- Joint survey between two large collieries. Source of error in correlation- permissible error, correlation survey problems.

**Unit- IV Curve Setting**

- Objective of curve setting; definition of circular curves such as simple curves, compound curves, reverse curves, and transition curves, designation of curves.
- Elements of simple circular curves.
- Different methods of setting out simple circular curve: by chord & off set method, by chord and angle method, by Rankine's method of tangential angle (using one theodolite, two theodolites)
- Elements of compound curves, super elevation-necessity of superelevation computation.
- Numerical problems on curve setting.

**Unit- V Mine Triangulation (plane triangle only)**

- Principle of triangulation survey, classifications, triangulation figures, consideration for selection of triangulation stations, condition of adjustment of braced quadrilateral and polygon with a central station.
- Baseline measurement by traditional methods, correction to be applied for measuring base.
- Procedure for triangulation survey: Extension of base line, double extension of baseline, broken base, satellite station and National grid.
- Field Astronomy- common astronomical terms, different methods of determination of true north, determination of true north by observation to a circumpolar star.

**Unit- VI Introduction to Subsidence Survey & Stope Survey**

- Subsidence survey- Introduction, purpose, subsidence plan and section (brief idea only).
- Stope survey- Introduction, purpose, instruments used;
- Stope survey methods- Tape triangulation & Shrinkage stope survey (brief idea only).

**Unit- VII Dip & Fault Problem and Volume Calculation**

- Derivation of the formula used to connect True dip, apparent dip and included angles. Problems on Dip. Borehole problems for determining the dip (amount and direction) of seams.
- Borehole problems associated with faults.
- Concept of drift. Numerical problems on drift associated with dip and fault.
- Volume calculations of coal heaps.

**Suggested learning resources:**

1. Punmia, B.C,; Jain, Ashok Kumar; Jain, Arun Kumar, Surveying I, Laxmi Publications, New Delhi.

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

**Course outcomes:**

After completing this course, student will be able to:

- Know how to conduct Tachometric surveys for various cases.
- Conduct dial surveying in mines to prepare plans.
- Correlate surface surveying data with underground survey work and know how to conduct joint surveys.
- Understand various curve setting techniques used in mines.
- Know about mine triangulation by plane triangles.
- Get introductory ideas on subsidence surveys and stope surveys.
- Solve problems related to Dip, Strike, Drift etc. of a seam or orebody and calculate volume of a coal heap.

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| | | |
|---|---|---|
| Course Code | : | MINPE 522 |
| Course Title | : | Introduction to Petroleum & Natural Gas Engineering |
| Number of Credits | : | 3 (L : 3, T : 0, P : 0) |
| Prerequisites | : | Basic knowledge in Mathematics, Physics, Chemistry & Engineering Graphics |
| Course Category | : | PE |

**TOPIC WISE DISTRIBUTION OF THE COURSE:**

| UNIT | TOPIC | LECTURE PERIODS | TUTORIAL PERIODS |
|---|---|---|---|
| I | **Introduction & Formation of Hydrocarbons** | 9 | 0 |
| II | **Geology of Hydrocarbons** | 6 | 0 |
| III | **Exploration & Drilling** | 12 | 0 |
| IV | **Production** | 9 | 0 |
| V | **Unconventional Resources** | 9 | 0 |

**Course Objectives:**

Following are the objectives of this course:

- To become familiar with the petroleum and natural gas industry.
- To know about formation of different types of hydrocarbons.
- To become familiar with the geology behind the formation of hydrocarbons.
- To become familiar with the geophysical exploration techniques and different drilling rigs used in petroleum engineering.
- To become familiar with various production methods of oil and natural gas.
- To know about different types of unconventional oil and gas resources.

**Course Content:**

**UNIT-I Introduction & Formation of Hydrocarbon**

- Present global scenario of petroleum and natural gas industries.
- Petroleum deposits in india- Different oil fields in india
- Crude Oil, What made oil / Formation of crude oil , Generation of petroleum, Conversion of kerogen to oil & gas- Diagenesis, Catagenesis & Metagenesis.
- Chemical composition of Petroleum, API Gravity of crude ,Natural Gas, Condensates.
- Definitions of Wet Gas, Dry Gas, Sour Gas, Acid Gas, LPG, LNG & CNG.

**UNIT-II Geology of Hydrocarbons**

- Parameters controlling the occurrence of petroleum, Source rock, Reservoir rock, Oil Traps.
- Migration of petroleum.
- Entrapment of Petroleum- Structural traps, Stratigraphic traps, Combination traps.

**UNIT-III Exploration & Drilling**

- Brief discussions on Remote Sensing and different geophysical exploration techniques.
- Geological logging, Different types of geophysical logging (Name and definition only).
- Drilling Rigs- Different types of drilling rigs, Semi submersible, Platform-Steel jacket platform, Concrete gravity platform, Steel caisson platform, Complaint platform, Jack up, Drill ship, FPSO (Floating Production Storage and Offshore loading), Rotary drilling, Directional drilling, Well casing, Well completion, Types of well completion, Perforation, Well stimulation, Acidizing, Fracturing.

**UNIT-IV Production**

- Production Tree, Flowing Wells, Artificial Lift-Beam Pumping, Submersible pumping, Gas Lift & Hydraulic pumping.

**UNIT-V Unconventional Resources**

- Unconventional oils- Oil Sand & Heavy Oil, Oil Shale, Tight Oils.
- Unconventional gas resources- Shale Gas, Tight Gas.
- CBM (Coal Bed Methane)- Occurrence, Desorption of methane and its emission to underground openings, Methane drainage- Brief discussions on different methods of methane drainage.
- Related Regulations of CMR, 2017.
- Methane Hydrate.

**Suggested learning resources:**

1. Principles of Engineering Geology by K.M Bangar
2. Encyclopaedia of petroleum science and engineering (drilling and drilling fluids, well cementing, production and transport of oil and natural gas), vol.7 by S.L Sah.
3. Fundamentals of Oil & Gas Industry for Beginners by Samir Dalvi
4. Standard Handbook of Petroleum and Natural Gas Engineering by William Lyons , Gary J Plisga BS , Michael Lorenz
5. Oil and Gas Production Handbook: An Introduction to Oil and Gas Production, Transport, Refining and Petrochemical Industry by Havard Devold.

**Course outcomes:**

After completing this course, student will be able to:

- Get informed about the current scenario & future possibilities of the oil and natural gas industries.
- Understand the formation & occurrence of petroleum and natural gases.

- Understand the formation, migration and entrapment into underground rocks of petroleum and natural gas.
- Demonstrate the different types of exploration techniques and drilling rigs used in the production of petroleum and natural gases.
- Understand the various techniques of production of petroleum products.
- Acquire fundamental knowledge about unconventional oil and natural gas resources.

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| | | |
|---|---|---|
| Course Code | : | MINPE 523 |
| Course Title | : | Modern Mine Machinery |
| Number of Credits | : | 3 (L : 3, T : 0, P : 0) |
| Prerequisites | : | Basic knowledge in Mathematics, Physics, Chemistry & Engineering Graphics |
| Course Category | : | PE |

**TOPIC WISE DISTRIBUTION OF THE COURSE:**

| UNIT | TOPIC | LECTURE PERIODS | TUTORIAL PERIODS |
|---|---|---|---|
| I | **Use of electricity in mine** | 12 | 0 |
| II | **Coal cutting machines** | 9 | 0 |
| III | **Mechanical loaders** | 3 | 0 |
| IV | **Bucket loaders** | 9 | 0 |
| V | **Man riding Systems** | 6 | 0 |
| VI | **Mine Pumps (Other than centrifugal & reciprocating pumps)** | 6 | 0 |

**Course Objectives:**

Following are the objectives of this course:

- To get familiar with the electrical equipment used in underground mines.
- To understand the constructional features and applications of different coal cutting machines.
- To get familiar with the different mechanical loaders used in mines.

- To understand the constructional features and applications of widely used bucket loaders.
- To know the different man riding systems in belowground mines.
- To have knowledge on some pumps used in mines.

**Course Content:**

**Unit- I Use of electricity in mine**

- Mining cables - Classification, constructional features and use of each type - armoured, pliable armoured and trailing cable; Voltage limitations
- Installation of cable in surface, underground roadways & face; Permissible length & care of cable; Joint box- Constructional features & uses
- General working principles of Gate End Box, various safety provisions incorporated, basic remote control circuit - function of Pilot core protection & earth leakage protection
- Function & operation of drill panel
- Flameproof, intrinsically safe & increased safety type 'e' apparatus- application, features & safety aspects
- Underground signalling arrangement- haulage signals, shaft signals and use of telephone underground.

**Unit- II Coal cutting machines**

- Continuous Miner- constructional features, production capacity and application
- Shearer- constructional features, production capacity and application
- Plough- constructional features, production capacity and application

**Unit- III Mechanical loaders**

- Gathering arm loader- constructional features, production capacity and application
- Shearer loader- constructional features, production capacity and application

**Unit- IV Bucket loaders**

- Scraper loader- constructional features, production capacity and application
- Side discharge loader-constructional features, production capacity and application
- Load haul dumper- constructional features, production capacity and application
- Shuttle car/ Ram car- constructional features, production capacity and application

**Unit- V Man riding Systems**

- Manriding system- Introduction, Advantages & Different Types.
- Chair Lifting Manriding System- construction, operation & safety features.

- Track or rail mounted car system.
- Trackless man transport system- Mine Crusher, Drift Runner or Man Rider

**Unit- VI Mine Pumps (Other than centrifugal & reciprocating pumps)**

- Sources of water underground.
- Principle and operation of Syphon.
- Ram pump- constructional features, working and use.
- Turbine pump- constructional features, working and use; End thrust in turbine pump & its balancing.
- Mono/ Roto pump - constructional features , working and use.
- Troubles in pumps & remedial measures.
- Main sump at pit bottom.

**Suggested learning resources:**


1. Das, S. K., Modern Coal Mining Technology, Lovely Prakashan, Dhanbad, 1992
2. Singh, R. D., Principles & Practices of Modern Coal Mining, New Age International, New Delhi, 1997
3. Elements of Mining Technology, Vol.3 by D J Deshmukh
4. The Universal School of Mines, Vol. 2
5. A Study of CEA (Measures relating to Safety & Electric Supply) REGULATIONS, 2010 by L C Kaku
6. Ali Murtoja Shaikh, A Handbook for MINING Professional, Lovely Prakashan, Dhanbad
7. Statham, I. C. F., Coal Mining Practice, Caxton eastern agencies, Calcutta, Reprint, 1964


**Course outcomes:**

After completing this course, student will be able to:

- Apply the acquired knowledge of use of electricity in supervision of different equipment in mines.
- Supervise the operation of different coal cutting machines.
- Supervise the operations of various mechanical loaders used in mines.
- Select bucket loaders for deployment in mines under different geomining conditions and supervise operation of the same.
- Have fundamental ideas on the man riding systems in belowground mines.
- Supervise workings of pumps used in mines.

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| | | |
|---|---|---|
| Course Code | : | MINPE 523 |
| Course Title | : | Mineral Dressing |
| Number of Credits | : | 3 (L : 3, T : 0, P : 0) |
| Prerequisites | : | Basic knowledge in Mathematics, Physics, Chemistry & Engineering Graphics |
| Course Category | : | PE |

**TOPIC WISE DISTRIBUTION OF THE COURSE:**

| UNIT | TOPIC | LECTURE PERIODS | TUTORIAL PERIODS |
|---|---|---|---|
| I | **Introduction** | 12 | 0 |
| II | **Comminution** | 6 | 0 |
| III | **Laboratory and Industrial Sizing and Sampling and Control** | 9 | 0 |
| IV | **Separation/Concentration** | 6 | 0 |
| V | **Special Methods** | 12 | 0 |

**Course Objectives:**

The objective of this course:

- To become familiar with the various mineral processing methods used in the mining sector.

**Course Content:**

**Unit- I Introduction**

- Scope, objectives and minerals/ores for mineral processing
- Methods of treatment, choice of methods and sequence of operations
- Product and flow sheets
- Ore sorting – hand mechanical, electronic
- Removal of harmful materials
- Ore transportation.

**Unit- II Comminution**

- Introduction to comminution
- Primary/secondary/tertiary crushing
- Purpose, duty and theory of crushing
- Crushing sequence and reduction ratio
- Types of crushers and comparison
- General crushing flow sheet
- Wet/dry grinding
- Mechanism and various affecting parameters

**Unit- III Laboratory and Industrial Sizing and Sampling and Control**

- Purpose, factors and governing particle behaviour.
- Laboratory and industrial screens, trommels, vibrating screens, etc.
- Wet and dry screening, classification, classifiers- Purpose
- Sampling - solid ore, pulp, head feed, grinding circuit samples, flotation products etc.
- X-ray fluorescence, automatic sampling. Metallurgical accounting

**Unit- IV Separation/Concentration**

- Newton‟s and Stoke‟s Laws of particle settlement
- Different concentration techniques – gravity, chemical froth flotation, wet & dry magnetic separation, electromagnetic, amalgamation, heavy media, jigging, shaking tables, sluicing, spirals, thickeners, filtration, etc.
- Coal washing.

**Unit- V Special Methods**

- Chemical extraction
- Cyanide process, leaching, use of ion exchange, solvent extraction
- Pilot plant studies on ores, tailing dams; generalised plant practice/flow sheets for coal and other important ores – copper, aluminium, lead, zinc, silver, gold, uranium, iron, limestone, magnesite

**Suggested learning resources:**


1. Jain, S.K., Ore Processing, Oxford – IBH Publishing, 1984.
2. Gaudin, A.M., Principles of Mineral Dressing – McGraw Hill Book Company, 1971.
3. Taggart, A.F., Handbook of Mineral Dressing, John Wiley and Sons, New York, 1990.
4. Wills, B.A. Mineral Processing Technology, Pergamon Press, 1985.


**Course outcomes:**

After completing this course, student will be able to:

- understand the different mineral processing methods and practice in the mining sector without the aid of Mineral Engineers.

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| | | |
|---|---|---|
| Course Code | : | MINSI 541 |
| Course Title | : | Internship- II |
| Number of Credits | : | 1 (L : 0, T : 0, P : 0) |
| Prerequisites | : | Basic knowledge in Physics, Chemistry & Engineering Graphics |
| Course Category | : | SI |

**Procedures to be observed:**

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

After completion of the Internship, the students are required to -

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

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

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|---|---|---|
| Course Code | : | MINPR 551 |
| Course Title | : | Major Project |
| Number of Credits | : | 2 (L : 0, T : 0, P : 4) |
| Prerequisites | : | Knowledge of all courses that have been taught till date |
| Course Category | : | PR |

**Course Objectives:**

Following are the objectives of this course:

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

**Procedures to be observed:**

Students will carry out their Project Work in group or individually under the supervision of a Faculty of their department who will work as a Project Guide. Number of students per group may vary with the strength of the students and the topics provided.

The Major Project shall include preparation of a Project Report which, among other things, consists of technical description of the project. The Report should be submitted in two copies, one to be retained in the library of the institute. The students shall prepare a presentation on the project topic and deliver it and/or face viva-voce.

**The Major Project work will be based mainly on the topic of Mining Engineering courses.**

**Course outcomes:**

After completing this course, student will be able to:

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

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