****

**REPUBLIC OF KENYA**

**COMPETENCY BASED CURRICULUM**

**FOR**

**MINING TECHNOLOGY**

**LEVEL 6**



TVET CDACC

P.O. BOX 15745-00100

NAIROBI

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# FOREWORD

The provision of quality education and training is fundamental to the Government’s overall strategy for social economic development. Quality education and training will contribute to achievement of Kenya’s development blueprint and sustainable development goals.

Reforms in the education sector are necessary for the achievement of Kenya Vision 2030 and meeting the provisions of the Constitution of Kenya 2010. The education sector had to be aligned to the Constitution and this resulted to the formulation of the Policy Framework for Reforming Education and Training. A key feature of this policy is the radical change in the design and delivery of the TVET training. This policy document requires that training in TVET be competency based, curriculum development be industry led, certification be based on demonstration of competence and mode of delivery allows for multiple entry and exit in TVET programmes.

These reforms demand that Industry takes a leading role in curriculum development to ensure the curriculum addresses its competence needs. It is against this background that this curriculum has been developed.

It is my conviction that this curriculum will play a great role towards development of competent human resource for the Mining sector’s growth.

**PRINCIPAL SECRETARY**

**VOCATIONAL AND TECHNICAL TRAINING**

**MINISTRY OF EDUCATION**

# PREFACE

Kenya Vision 2030 aims to transform the country into a newly industrializing, “middle-income country providing a high-quality life to all its citizens by the year 2030”. Kenya intends to create a globally competitive and adaptive human resource base to meet the requirements of a rapidly industrializing economy through life-long education and training. TVET has a responsibility of facilitating the process of inculcating knowledge, skills and attitudes necessary for catapulting the nation to a globally competitive country, hence the paradigm shift to embrace Competency Based Education and Training (CBET).

The Technical and Vocational Education and Training Act No. 29 of 2013 on Reforming Education and Training in Kenya, emphasized the need to reform curriculum development, assessment and certification. This called for shift to CBET to address the mismatch between skills acquired through training and skills needed by industry as well as increase the global competitiveness of Kenyan labour force.

This curriculum is designed and organized with an outline of learning outcomes; suggested delivery methods, training/learning resources and methods of assessing the trainee’s achievement. The curriculum is competency-based and allows multiple entry and exit to the course.

This curriculum has been developed following the CBET framework policy; the CBETA Standards and guidelines provided by the TVET Authority and the Kenya National Qualification framework designed by the Kenya National Qualification Authority.

I am grateful to the Council members, Council Secretariat, Energy and extractives Sector Skills Advisory Committee (SSAC), expert workers and all those who participated in the development of this curriculum.

**CHAIRPERSON**

**TVET CDACC**

# ACKNOWLEDGEMENT

This curriculum has been designed for competency-based training and has independent units of learning that allow the trainee flexibility in entry and exit. In developing the curriculum, significant involvement and support was received from various organisations.

I recognize with appreciation the role of the Energy and extractives SSAC in ensuring that competencies required by the industry are addressed in the curriculum. I also thank all stakeholders in the energy and extractive sector for their valuable input and all those who participated in the process of developing this curriculum.

I am convinced that this curriculum will go a long way in ensuring that workers in Energy and extractives sector acquire competencies that will enable them to perform their work more efficiently.

**COUNCIL SECRETARY/CEO**

**TVET CDACC**

# ABBREVIATION AND ACRONYMS

BC Basic competency

CBET Competency Based Education and Training

CC Common competency

CDACC Curriculum Development, Assessment and Certification Council

CR Core competency

CU Curriculum

ENG Engineering

KCSE Kenya Certificate of Secondary Education

KNQA Kenya National Qualifications Authority

OSH Occupational Safety and Health

PPE Personal Protective Equipment

SSAC Sector Skills Advisory Committee

TVET Technical and Vocational Education and Training

#

# KEY TO UNIT CODE

 MIN /CU /MT/BC /01/ 6/ A

Industry or sector

Curriculum

Occupational area

Type of competency

Competency number

Competency level

Version control

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# COURSE OVERVIEW

Mining Technology Level 6 consists of competencies that a person must achieve to enable him/her to develop mine design, manage: mine HSE, drilling and blasting, loading and haulage, ore crushing operations, mine ground stabilization, mine fluid flow and perform mine survey.

This course consists of the following basic, common and core units of learning:

**Basic Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit factor** |
| MIN/CU/MT/BC/01/6/A | Communication Skills | 40 | 4.0 |
| MIN/CU/MT/BC/02/6/A | Numeracy Skills | 60 | 6.0 |
| MIN/CU/MT/BC/03/6/A | Digital Literacy | 60 | 6.0 |
| MIN/CU/MT/BC/04/6/A | Entrepreneurial Skills | 100 | 10.0 |
| MIN/CU/MT/BC/05/6/A | Employability Skills | 80 | 8.0 |
| MIN/CU/MT/BC/06/6/A | Environmental Literacy | 40 | 4.0 |
| MIN/CU/MT/BC/07/6/A | Occupational Safety and Health Practices | 40 | 4.0 |
| **Total** | **420** | **42.0** |

**Common Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit of Learning Code** | **Unit of Learning Title** | **Duration in Hours** | **Credit Factors** |
| MIN/CU/MT/CC/01/6/A | Technical Drawing | 100 | 10.0 |
| MIN/CU/MT/CC/02/6/A | Mathematics Principles  | 140 | 14.0 |
| MIN/CU/MT/CC/03/6/A | Chemistry Principles | 105 | 10.5 |
| MIN/CU/MT/CC/04/6/A | Physics Principles  | 100 | 10.0 |
| MIN/CU/MT/CC/05/6/A | Research Methods | 85 | 8.5 |
| **Total** | **530** | **53.0** |

**Core Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit of Learning Code** | **Unit of Learning Title** | **Duration in Hours** | **Credit Factors** |
| MIN/CU/MT/CR/01/6/A | Mine Design and Planning | 160 | 16.0 |
| MIN/CU/MT/CR/02/6/A | Mine Health, Safety and Environment  | 100 | 10.0 |
| MIN/CU/MT/CR/03/6/A | Drilling and Blasting  | 130 | 13.0 |
| MIN/CU/MT/CR/04/6/A | Loading and Haulage in Mines | 120 | 12.0 |
| MIN/CU/MT/CR/05/6/A | Ore Crushing Operation | 100 | 10.0 |
| MIN/CU/MT/CR/06/6/A | Mine Ground Stabilization  | 110 | 11.0 |
| MIN/CU/MT/CR/07/6/A | Mine Fluid Management | 120 | 12.0 |
| MIN/CU/MT/CR/08/6/A | Mine Survey | 130 | 13.0 |
|  | Industrial Attachment  | 480 | 48.0 |
| **Total** | **1450** | **145** |
| **Grand total** | **2400** | **240** |

**Entry Requirements**

A trainee entering this course should have any of the following minimum requirements:

1. Kenya Certificate of Secondary Education (KCSE) mean grade C- (minus).

**Or**

1. Mining technology Level 5 Certificate

**Or**

1. Equivalent qualification as determined by Kenya National Qualifications Authority (KNQA)

**Trainer qualification**

A trainer for this course should have a higher qualification than the level of this course.

**Assessment**

The course will be assessed at two levels: internal and external.

1. **Internal assessment**: conducted continuously by the trainer (internal assessor) who is monitored by an accredited internal verifier.
2. **External assessment**: conducted by an external assessor who is monitored by an accredited external verifier.

The assessors and verifiers are accredited by TVET CDACC which also coordinates external assessment.

**Certification**

An individual will be awarded a Certificate of Competency on demonstration of competence in a unit of competency. To be awarded a National Certificate in Mining Technology level 6 an individual must demonstrate competence in all the units of competency.

These certificates will be awarded by TVET CDACC in conjunction with the training provider.

# BASIC UNITS OF LEARNING

## COMMUNICATION SKILLS

**UNIT CODE:** MIN/CU/MT/BC/01/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Communication Skills

**Duration of Unit:** 40 hours

**Unit Description**

This unit covers the competencies required to demonstrate communication skills. It involves, meeting communication needs of clients and colleagues; developing communication strategies, establishing and maintaining communication pathways, conducting interviews, facilitating group discussion and representing the organization.

**Summary of Learning Outcomes**

1. Meet communication needs of clients and colleagues
2. Develop communication strategies
3. Establish and maintain communication pathways
4. Promote use of communication strategies
5. Conduct interview
6. Facilitate group discussion
7. Represent the organization

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Meet communication needs of clients and colleagues
 | * Communication process
* Modes of communication
* Medium of communication
* Effective communication
* Barriers to communication
* Flow of communication
* Sources of information
* Organizational policies
* Organization requirements for written and electronic communication methods
* Report writing
* Effective questioning techniques (clarifying and probing)
* Workplace etiquette
* Ethical work practices in handling communication
* Active listening
* Feedback
* Interpretation
* Flexibility in communication
* Types of communication strategies
* Elements of communication strategy
 | * Interview
* Written texts
 |
| 1. Develop communication strategies
 | * Dynamics of groups
* Styles of group leadership
* Openness and flexibility in communication
* Communication skills relevant to client groups
 | * Interview
* Written texts
 |
| 1. Establish and maintain communication pathways
 | * Types of communication pathways
 | * Interview
* Written texts
 |
| 1. Promote use of communication strategies
 | * Application of elements of communication strategies
* Effective communication techniques
 | * Interview
* Written texts
 |
| 1. Conduct interview
 | * Types of interview
* Establishing rapport
* Facilitating resolution of issues
* Developing action plans
 | * Interview
* Written texts
 |
| 1. Facilitate group discussion
 | * Identification of communication needs
* Dynamics of groups
* Styles of group leadership
* Presentation of information
* Encouraging group members participation
* Evaluating group communication strategies
 | * Interview
* Written texts
 |
| 1. Represent the organization
 | * Presentation techniques
* Development of a presentation
* Multi-media utilization in presentation
* Communication skills relevant to client groups
 | * Interview
* Written texts
 |

**Suggested Methods of Instruction**

* Discussion
* Role playing
* Simulation
* Direct instruction

**Recommended Resources**

* Desktop computers/laptops
* Internet connection
* Projectors
* Telephone

## NUMERACY SKILLS

**UNIT CODE:** MIN/CU/MT/BC/02/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Numeracy Skills.

**Duration of Unit:** 60 hours

**Unit Description**

This unit describes the competencies required to demonstrate numeracy skills. It involves applying a wide range of mathematical calculations for work; applying ratios, rates and proportions to solve problems; estimating, measuring and calculating measurement for work; using detailed maps to plan travel routes for work; using geometry to draw and construct 2D and 3D shapes for work; collecting, organizing and interpreting statistical data; using routine formula and algebraic expressions for work and using common functions of a scientific calculator.

**Summary of Learning Outcomes**

1. Apply a wide range of mathematical calculations for work
2. Apply ratios, rates and proportions to solve problems
3. Estimate, measure and calculate measurement for work
4. Use detailed maps to plan travel routes for work
5. Use geometry to draw and construct 2D and 3D shapes for work
6. Collect, organize and interpret statistical data
7. Use routine formula and algebraic expressions for work
8. Use common functions of a scientific calculator

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Apply a wide range of mathematical calculations for work
 | * Fundamentals of mathematics
* Addition, subtraction, multiplication and division of positive and negative numbers
* Algebraic expressions manipulation
* Forms of fractions, decimals and percentages
* Expression of numbers as powers and roots
 | * Written tests
* Assignments
* Supervised exercises
 |
| 1. Apply ratios, rates and proportions to solve problems
 | * Rates, ratios and proportions
* Meaning
* Conversions into percentages
* Direct and inverse proportions determination
* Performing calculations
* Construction of graphs, charts and tables
* Recording of information
 | * Written tests
* Assignments
* Supervised exercises
 |
| 1. Estimate, measure and calculate measurement for work
 | * Units of measurements and their symbols
* Identification and selection of measuring equipment
* Conversion of units of measurement
* Perimeters of regular figures
* Areas of regular figures
* Volumes of regular figures
* Carrying out measurements
* Recording of information
 | * Assignments
* Supervised exercises
* Written tests
 |
| 1. Use detailed maps to plan travel routes for work
 | * Identification of features in routine maps and plans
* Symbols and keys used in routine maps and plans
* Identification and interpretation of orientation of map to North
* Demonstrate understanding of direction and location
* Apply simple scale to estimate length of objects, or distance to location or object
* Give and receive directions using both formal and informal language
* Planning of routes
* Calculation of distance, speed and time
 | * Written
* Practical test
 |
| 1. Use geometry to draw and construct 2D and 3D shapes for work
 | * Identify two dimensional shapes and routine three dimensional shapes in everyday objects and in different orientations
* Explain the use and application of shapes
* Use formal and informal mathematical language and symbols to describe and compare the features of two dimensional shapes and routine three dimensional shapes
* Identify common angles
* Estimate common angles in everyday objects
* Evaluation of unknown angles
* Use formal and informal mathematical language to describe and compare common angles
* Symmetry and similarity
* Use common geometric instruments to draw two dimensional shapes
* Construct routine three dimensional objects from given nets
 |  |
| 1. Collect, organize and interpret statistical data
 | * + Classification of data
* Grouped data
* Ungrouped data
	+ Data collection
* Observation
* Recording
	+ Distinguishing between sampling and census
	+ Importance of sampling
	+ Errors in sampling
	+ Types of sampling and their limitations e.g.
* Stratified random
* Cluster
* Judgmental
	+ Tabulation of data
* Class intervals
* Class boundaries
* Frequency tables
* Cumulative frequency
	+ Diagrammatic and graphical presentation of data e.g.
* Histograms
* Frequency polygons
* Bar charts
* Pie charts
* Cumulative frequency curves
	+ Interpretation of data
 | * Assignments
* Supervised exercises
* Written tests
 |
| 1. Use routine formula and algebraic expressions for work
 | * + Solving linear equations
	+ Linear graphs
* Plotting
* Interpretation
* Applications of linear graphs
* Curves of first and second degree
* Plotting
* Interpretation
 | * Assignments
* Supervised exercises
* Written tests
 |
| 8. Use common functions of a scientific calculator | * Identify and use keys for common functions on a calculator
* Calculate using whole numbers, money and routine decimals and percentages
* Calculate with routine fractions and percentages
* Apply order of operations to solve multi-step calculations
* Interpret display and record result
 | * Written
* Practical test
 |

**Suggested Methods of Instruction**

* Group discussions
* Demonstration by trainer
* Practical work by trainee
* Exercises

**Recommended Resources**

* Calculators
* Rulers, pencils, erasers
* Charts with presentations of data
* Graph books
* Dice

## DIGITAL LITERACY

**UNIT CODE:** MIN/CU/MT/BC/03/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Digital Literacy

**Duration of Unit:** 60 hours

**Unit Description**

This unit describes competencies required to demonstrate digital literacy. It involves in identifying computer software and hardware, applying security measures to data, hardware, software in automated environment, computer software in solving task, internet and email in communication at workplace, desktop publishing in official assignments and preparing presentation packages.

**Summary of Learning Outcomes**

1. Identify computer software and hardware
2. Apply security measures to data, hardware, software in automated environment
3. Apply computer software in solving tasks
4. Apply internet and email in communication at workplace
5. Apply desktop publishing in official assignments
6. Prepare presentation packages

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify computer hardware and software
 | * Concepts of ICT
* Functions of ICT
* History of computers
* Components of a computer
* Classification of computers
 | * Written tests
* Oral presentation
 |
| 1. Apply security measures to data, hardware, software in automated environment
 | * Data security and control
* Security threats and control measures
* Types of computer crimes
* Detection and protection against computer crimes
* Laws governing protection of ICT
 | * Written tests
* Oral presentation
* Project
 |
| 1. Apply computer software in solving tasks
 | * Operating system
* Word processing
* Spread sheets
* Data base design and manipulation
* Data manipulation, storage and retrieval
 | * Oral questioning
* Project
 |
| 1. Apply internet and email in communication at workplace
 | * Computer networks
* Network configurations
* Uses of internet
* Electronic mail (e-mail) concept
 | * Oral questioning
* Written report
 |
| 1. Apply desktop publishing in official assignments
 | * Concept of desktop publishing
* Opening publication window
* Identifying different tools and tool bars
* Determining page layout
* Opening, saving and closing files
* Drawing various shapes using DTP
* Using colour pellets to enhance a document
* Inserting text frames
* Importing and exporting text
* Object linking and embedding
* Designing of various publications
* Printing of various publications
 | * Oral questioning
* Written report
* Project
 |
| 1. Prepare presentation packages
 | * Types of presentation packages
* Procedure of creating slides
* Formatting slides
* Presentation of slides
* Procedure for editing objects
 | * Oral questioning
* Written report
* Project
 |

**Suggested Methods of Instruction**

* Instructor led facilitation of theory
* Demonstration by trainer
* Practical work by trainee
* Viewing of related videos
* Project
* Group discussions

**Recommended Resources**

* Computers
* Printers
* Storage devices
* Internet access

## ENTREPRENEURIAL SKILLS

**UNIT CODE:** MIN/CU/MT/BC/04/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Entrepreneurial Skills

**Duration of unit:** 100 hours

**Unit Description**

This unit covers the competencies required to demonstrate understanding of entrepreneurship. It involves demonstrating understanding of an entrepreneur, entrepreneurship and self-employment. It also involves identifying entrepreneurship opportunities, creating entrepreneurial awareness, applying entrepreneurial motivation and developing business innovative strategies.

**Summary of Learning Outcomes**

* 1. Demonstrate understanding of who an entrepreneur
	2. Demonstrate knowledge of entrepreneurship and self-employment
	3. Identify entrepreneurship opportunities
	4. Create entrepreneurial awareness
	5. Apply entrepreneurial motivation
	6. Develop business innovative strategies
	7. Develop Business plan

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Demonstrate knowledge of entrepreneurship and self-employment
 | * Importance of self-employment
* Requirements for entry into self-employment
* Role of an Entrepreneur in business
* Contributions of Entrepreneurs to National development
* Entrepreneurship culture in Kenya
* Born or made entrepreneurs
 | * Individual/group assignments
* Projects
* Written tests
* Oral questions
* Third party report
 |
| 1. Identify entrepreneurship opportunities
 | * Business ideas and opportunities
* Sources of business ideas
* Business life cycle
* Legal aspects of business
* Assessment of product demand
* Business environment
* Factors to consider when evaluating business environment
* Technology in business
 | * Individual/group assignments
* Projects
* Written tests
* Oral questions
* Third party report
* Interviews
 |
| 1. Create entrepreneurial awareness
 | * Forms of businesses
* Sources of business finance
* Factors in selecting source of business finance
* Governing policies on Small Scale Enterprises (SSEs)
* Problems of starting and operating SSEs
 | * Individual/group assignments
* Projects
* Written tests
* Oral questions
* Third party report
* Interviews
 |
| 1. Apply entrepreneurial motivation
 | * Internal and external motivation
* Motivational theories
* Self-assessment
* Entrepreneurial orientation
* Effective communications in entrepreneurship
* Principles of communication
* Entrepreneurial motivation
 | * Case studies
* Individual/group assignments
* Projects
* Written tests
* Oral questions
* Third party report
* Interviews
 |
| 1. Develop business innovative strategies
 | * Innovation in business
* Small business Strategic Plan
* Creativity in business development
* Linkages with other entrepreneurs
* ICT in business growth and development
 | * Case studies
* Individual/group assignments
* Projects
* Written tests
* Oral questions
* Third party report
* Interviews
 |
| 1. Develop Business Plan
 | * Business description
* Marketing plan
* Organizational/Management
* plan
* Production/operation plan
* Financial plan
* Executive summary
* Presentation of Business Plan
 | * Case studies
* Individual/group assignments
* Projects
* Written tests
* Oral questions
* Third party report
* Interviews
 |

**Suggested Methods of Instruction**

* Direct instruction
* Project
* Case studies
* Field trips
* Discussions
* Demonstration
* Question and answer
* Problem solving
* Experiential
* Team training

**Recommended Resources**

* Case studies
* Business plan templates
* Computers
* Overhead projectors
* Internet
* Mobile phone
* Video clips
* Films
* Newspapers and Handouts
* Business Journals
* Writing materials

## EMPLOYABILITY SKILLS

**UNIT CODE:** MIN/CU/MT/BC/05/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Employability Skills

**Duration of Unit:** 80 hours

**Unit Description**

This unit covers competencies required to demonstrate employability skills. It involves conducting self-management, demonstrating interpersonal communication, critical safe work habits, leading a workplace team, planning and organizing work, maintaining professional growth and development, demonstrating workplace learning, problem solving skills and managing ethical performance.

**Summary of Learning Outcomes**

1. Conduct self-management
2. Demonstrate interpersonal communication
3. Demonstrate critical safe work habits
4. Lead a workplace team
5. Plan and organize work
6. Maintain professional growth and development
7. Demonstrate workplace learning
8. Demonstrate problem solving skills
9. Manage ethical performance

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Conduct self-management
 | * Self-awareness
* Formulating personal vision, mission and goals
* Strategies for overcoming life challenges
* Managing emotions
* Emotional intelligence
* Assertiveness versus aggressiveness
* Expressing personal thoughts, feelings and beliefs
* Developing and maintaining high self-esteem
* Developing and maintaining positive self-image
* Setting performance targets
* Monitoring and evaluating performance
* Articulating ideas and aspirations
* Accountability and responsibility
* Good work habits
* Self-awareness
* Values and beliefs
* Self-development
* Financial literacy
* Healthy lifestyle practices
* Adopting safety practices
 | * Written tests
* Oral questioning
* Interviewing
* Portfolio of evidence
* Third party report
 |
| 1. Demonstrate interpersonal communication
 | * Meaning of interpersonal communication
* Listening skills
* Types of audience
* Public speaking
* Writing skills
* Negotiation skills
* Reading skills
* Meaning of empathy
* Understanding customers’ needs
* Establishing communication networks
* Assertiveness
* Sharing information
 | * Written tests
* Oral questioning
* Interviewing
* Portfolio of evidence
* Third party report
 |
| 1. Demonstrate critical safe work habits
 | * Stress and stress management
* Time concept
* Punctuality and time consciousness
* Leisure
* Integratingpersonal objectives into organizational objectives
* Resources mobilization
* Resources utilization
* Setting work priorities
* Developing healthy relationships
* HIV and AIDS
* Drug and substance abuse
* Managing emerging issues
 | * Written tests
* Oral questioning
* Interviewing
* Portfolio of evidence
* Third party report
 |
| 1. Lead a workplace team
 | * Leadership qualities
* Power and authority
* Team building
* Determination of team roles and objectives
* Team parameters and relationships
* Individual responsibilities in a team
* Forms of communication
* Complementing team activities
* Gender and gender mainstreaming
* Human rights
* Developing healthy relationships
* Maintaining relationships
* Conflicts and conflict resolution
* Coaching and mentoring skills
 | * Written tests
* Oral questioning
* Interviewing
* Portfolio of evidence
* Third party report
 |
| 1. Plan and organize work
 | * Functions of management
* Planning
* Organizing
* Time management
* Decision making concept
* Task allocation
* Developing work plans
* Developing work goals/objectives and deliverables
* Monitoring work activities
* Evaluating work activities
* Resource mobilization
* Resource allocation
* Resource utilization
* Proactive planning
* Risk evaluation
* Problem solving
* Collecting, analysing and organising information
* Negotiation
 | * Written tests
* Oral questioning
* Interviewing
* Portfolio of evidence
* Third party report
 |
| 1. Maintain professional growth and development
 | * Avenues for professional growth
* Training and career opportunities
* Assessing training needs
* Mobilizing training resources
* Licenses and certifications for professional growth and development
* Pursuing personal and organizational goals
* Managing work priorities and commitments
* Recognizing career advancement
 | * Written tests
* Oral questioning
* Interviewing
* Portfolio of evidence
* Third party report
 |
| 1. Demonstrate workplace learning
 | * Managing own learning
* Mentoring
* Coaching
* Contributing to the learning community at the workplace
* Cultural aspects of work
* Networking
* Variety of learning context
* Application of learning
* Safe use of technology
* Taking initiative/proactivity
* Flexibility
* Identifying opportunities
* Generating new ideas
* Workplace innovation
* Performance improvement
* Managing emerging issues
* Future trends and concerns in learning
 | * Written tests
* Oral questioning
* Interviewing
* Portfolio of evidence
* Third party report
 |
| 1. Demonstrate problem solving skills
 | * Critical thinking process
* Data analysis tools
* Decision making
* Creative thinking
* Development of creative, innovative and practical solutions
* Independence in identifying and solving problems
* Solving problems in teams
* Application of problem-solving strategies
* Testing assumptions
* Resolving customer concerns
 | * Written tests
* Oral questioning
* Interviewing
* Portfolio of evidence
* Third party report
 |
| 1. Manage ethical performance
 | * Meaning of ethics
* Ethical perspectives
* Principles of ethics
* Ethical standards
* Organization code of ethics
* Common ethical dilemmas
* Organization culture
* Corruption, bribery and conflict of interest
* Privacy and data protection
* Diversity, harassment and mutual respect
* Financial responsibility/accountability
* Etiquette
* Personal and professional integrity
* Commitment to jurisdictional laws
* Emerging issues in ethics
 | * Written tests
* Oral questioning
* Interviewing
* Portfolio of evidence
* Third party report
 |

**Suggested Methods of Instruction**

* Demonstrations
* Simulation/Role play
* Group Discussion
* Presentations
* Assignments
* Q&A

**Recommended Resources**

* Computers
* Stationery
* Charts
* Video clips
* Audio tapes
* Radio sets
* TV sets
* LCD projectors

## ENVIRONMENTAL LITERACY

**UNIT CODE**:MIN/CU/MT/BC/06/6/A

**Relationship to Occupational Standards**:

This unit addresses the Unit of Competency : Demonstrate Environmental Literacy

**Duration of Unit:** 40 hours

**Unit Description**

This unit describes the competencies required demonstrate environmental literacy.it involves controlling environmental hazard, controlling environmental pollution, complying with workplace sustainable resource use, evaluating current practices in relation to resource usage, identifying environmental legislations/conventions for environmental concerns, implementing specific environmental programs, monitoring activities on environmental protection/programs, analysing resource use and developing resource conservation plans.

**Summary of Learning Outcomes**

1. Control environmental hazard
2. Control environmental Pollution
3. Demonstrate sustainable resource use
4. Evaluate current practices in relation to resource usage
5. Identify Environmental legislations/conventions for environmental concerns
6. Implement specific environmental programs
7. Monitor activities on Environmental protection/Programs
8. Analyze resource use
9. Develop resource conservation plans

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** |  **Content** | **Suggested Assessment Methods** |
| 1. Control environmental hazard
 | * Purposes and content of Environmental Management and Coordination Act 1999
* Storage methods for environmentally hazardous materials
* Disposal methods of hazardous wastes
* Types and uses of PPE in line with environmental regulations
* Occupational Safety and Health Standards (OSHS)
 | * Written questions
* Oral questions
 |
| 1. Control environmental Pollution control
 | * Types of pollution
* Environmental pollution control measures
* Types of solid wastes
* Procedures for solid waste management
* Different types of noise pollution
* Methods for minimizing noise pollution
 | * Written questions
* Oral questions
* Role play
 |
| 1. Demonstrate sustainable resource use
 | * Types of resources
* Techniques in measuring current usage of resources
* Calculating current usage of resources
* Methods for minimizing wastage
* Waste management procedures
* Principles of 3Rs (Reduce, Reuse, Recycle)
* Methods for economizing or reducing resource consumption
 | * Written questions
* Oral questions
* Role play
 |
| 1. Evaluate current practices in relation to resource usage
 | * Collection of information on environmental and resource efficiency systems and procedures,
* Measurement and recording of current resource usage
* Analysis and recording of current purchasing strategies.
* Analysis of current work processes to access information and data
* Identification of areas for improvement
 | * Written questions
* Oral questions
* Role play
 |
| 1. Identify Environmental legislations/conventions for environmental concerns
 | * Environmental issues/concerns
* Environmental legislations /conventions and local ordinances
* Industrial standard /environmental practices
* International Environmental Protocols (Montreal, Kyoto)
* Features of an environmental strategy
 | * Written questions
* Oral questions
 |
| 1. Implement specific environmental programs
 | * Community needs and expectations
* Resource availability
* 5s of good housekeeping
* Identification of programs/Activities
* Setting of individual roles /responsibilities
* Resolving problems /constraints encountered
* Consultation with stakeholders
 | * Written questions
* Oral questions
* Role play
 |
| 1. Monitor activities on Environmental protection/Programs
 | * Periodic monitoring and Evaluation of activities
* Gathering feedback from stakeholders
* Analyzing data gathered
* Documentation of recommendations and submission
* Setting of management support systems to sustain and enhance the program
* Monitoring and reporting of environmental incidents to concerned /proper authorities
 | * Oral questions
* Written tests
* Practical test
 |
| 1. Analyze resource use
 | * Identification of resource consuming processes
* Determination of quantity and nature of resource consumed
* Analysis of resource flow through different parts of the process.
* Classification of wastes for possible source of resources.
 | * Written tests
* Oral questions
* Practical test
 |
| 1. Develop resource Conservation plans
 | * Determination of efficiency of use/conversion of resources
* Causes of low efficiency of use of resources
* Plans for increasing the efficiency of resource use
 | * Written tests
* Oral questions
* Practical test
 |

**Suggested Methods of Instruction**

* Instructor led facilitation of theory
* Practical demonstration of tasks by trainer
* Practice by trainees
* Observations and comments and corrections by trainers

**Recommended Resources**

* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Environmental Management and Coordination Act 1999
* Machine/equipment manufacturer’s specifications and instructions
* Personal Protective Equipment (PPE)
* ISO standards
* Company environmental management systems (EMS)
* Montreal Protocol
* Kyoto Protocol

## OCCUPATIONAL SAFETY AND HEALTH PRACTICES

**UNIT CODE:** MIN/CU/MT/BC/07/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Demonstrate Occupational Safety and Health Practices

**Duration of Unit:** 40 hours

**Unit Description**

This unit specifies the competencies required to demonstrate occupational health and safety practices. It involves identifying workplace hazards and risk, identifying and implementing appropriate control measures to hazards and risks and implementing OSH programs, procedures and policies/guidelines.

**Summary of Learning Outcomes**

1. Identify workplace hazards and risk
2. Control OSH hazards
3. Implement OSH programs

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify workplace hazards and risks
 | * Identification of hazards in the workplace and/or the indicators of their presence
* Evaluation and/or work environment measurements of OSH hazards/risk existing in the workplace
* Gathering of OSH issues and/or concerns
 | * Oral questions
* Written tests
* Portfolio of evidence
* Third party report
 |
| 1. Control OSH hazards
 | * Prevention and control measures e.g. use of PPE
* Risk assessment
* Contingency measures
 | * Oral questions
* Written tests
* Portfolio of evidence
* Third party report
 |
| 1. Implement OSH

 programs | * Company OSH program, evaluation and review
* Implementation of OSH programs
* Training of team members and advice on OSH standards and procedures
* Implementation of procedures for maintaining OSH-related records
 | * Oral questions
* Written tests
* Portfolio of evidence
* Third party report
 |

**Suggested Methods of instruction**

* Assigments
* Discussion
* Q&A
* Role play
* Viewing of related videos

**Recommended Resources**

* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Machine/equipment manufacturer’s specifications and instructions
* Personal Protective Equipment (PPE) e.g.
* Mask
* Face mask/shield
* Safety boots
* Safety harness
* Arm/Hand guard, gloves
* Eye protection (goggles, shield)
* Hearing protection (ear muffs, ear plugs)
* Hair Net/cap/bonnet
* Hard hat
* Face protection (mask, shield)
* Apron/Gown/coverall/jump suit
* Anti-static suits
* High-visibility reflective vest

# COMMON UNITS OF LEARNING

## TECHNICAL DRAWING

**UNIT CODE:** MIN/CU/MT/CC/01/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Prepare and Interpret Technical Drawings

**Duration of Unit:** 100 Hours

**Unit Description**

This unit covers the competencies required to prepare and interpret technical drawings by a mining technician. It involves competencies to select, use drawing equipment and materials. It also involves producing plain geometry drawings, solid geometry drawings, pictorial and orthographic drawings of components and application of CAD software

**Summary of Learning Outcomes**

1. Use drawing equipment and materials
2. Produce plain geometry drawings
3. Produce solid geometry drawings
4. Produce pictorial and orthographic drawings of components
5. Apply CAD software

**Learning Outcomes, Content and Suggested Assessment Methods:**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Use drawing equipment and materials
 | * Identification of drawing equipment
* Identification of drawing materials
* Lab practise
 | * Observation
* Oral questioning
* Written tests
* Practical test
 |
| 1. Produce plain geometry drawings
 | * Lettering in drawing
* Types of lines in drawings
* Construction of geometric forms
* Construction of different angles
* Measurement of different angles
* Standard drawing conventions
 | * Observation
* Oral questioning
* Written tests
* Practical test
 |
| 1. Produce pictorial and orthographic drawings of components
 | * Terms and concepts in pictorial and orthographic drawings
* Drawing of isometric, oblique, axonometric, auxiliary and perspective views
* Drawing of first and third angle projections
* Sectioning of components
* Free hand sketching
 | * Observation
* Oral questioning
* Written tests
* Practical test
 |
| 1. Produce assembly drawings
 | * Explosion of orthographic views
* Explosion of pictorial views
* Identification and listing of parts
* Production of sectional views
* Hatching of drawings
 | * Observation
* Oral questioning
* Written tests
* Practical test
 |
| 1. Apply basic CAD software in drawing
 | * Types of CAD e.g.
* Auto CAD
* Archi CAD
* Solid works
* Inventor
* Circuit maker
* Electronic work bench
* 2D and 3D drafting techniques
* Annotation of models
 | * Observation
* Oral questioning
* Written tests
* Practical test
 |

**Suggested methods of Instruction**

* Projects
* Demonstration
* Practice by the trainee
* Industrial visits
* Group discussions
* Direct instructions

**Recommended Resources**

* + Drawing room
	+ Computer lab
	+ Drawing equipment and materials
	+ Computers
	+ CAD package
	+ Overhead projector

## MATHEMATICS PRINCIPLES

**UNIT CODE:** MIN/CU/MT/CC/02/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Apply Mathematics Principles

**Duration of Unit:** 140 hours

**UNIT DESCRIPTION**

This unit describes the competencies required to apply mathematics principles. It involves applying, algebra, trigonometry and hyperbolic functions, complex numbers, co-ordinate geometry and carry out binomial expansion. It also entails calculus, solving ordinary differential equations, carry out mensuration, power series, statistics, numerical methods, vector theory and matrices.

**Summary of Learning Outcomes**

1. Apply Algebra
2. Apply Trigonometry and hyperbolic functions
3. Apply complex numbers
4. Apply coordinate geometry
5. Carry out binomial expansion
6. Apply calculus
7. Solve ODE
8. Carry out mensuration
9. Apply power series
10. Apply statistics
11. Apply numerical methods
12. Apply vector theory
13. Apply matrix

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| * 1. Apply Algebra
 | * Indices
* Logarithms
* Solving mathematical problems
* Simultaneous equations
* Quadratic equations
 | * Written tests
* Observation
* Oral questions
* Third party report
* Interviews
 |
| * 1. Apply Trigonometry and hyperbolic functions
 | * Trigonometric rules
* Hyperbolic functions
 | * Written tests
* Observation
* Oral questions
* Third party report
* Interviews
 |
| * 1. Apply complex numbers
 | * Complex numbers
* Argand diagrams
* Calculations and functions
* De Moivre’s theorem
 | * Written tests
* Observation
* Oral questions
* Third party report
* Interviews
 |
| * 1. Apply Coordinate Geometry
 | * Polar equations
* Graphs
* Normal and tangents
 | * Written tests
* Observation
* Oral questions
* Third party report
* Interviews
 |
| * 1. Carry out Binomial Expansion
 | * Roots of numbers
* Errors and small changes
 | * Written tests
* Observation
* Oral questions
* Third party report
* Interviews
 |
| * 1. Apply Calculus
 | * Derivatives
	+ Algebraic functions
	+ Hyperbolic functions
	+ Inverse trigonometric functions
* Rate of change and small change
* stationery points of functions
* Integrals
	+ Algebraic functions
	+ Trigonometric functions
	+ Logarithmic functions
	+ Hyperbolic and inverse functions
 | * Written tests
* Observation
* Oral questions
* Third party report
* Interviews
 |
| * 1. Solve Ordinary differential equations
 | * First and second order differential equations
	+ Undetermined coefficients
	+ Boundary conditions
 | * Written tests
* Observation
* Oral questions
* Third party report
* Interviews
 |
| * 1. Carry out Mensuration
 | * Perimeter and areas of figures
* Volume and surface area of solids
* Area of irregular figures
* Pappus theorem
 | * Written tests
* Observation
* Oral questions
* Third party report
* Interviews
 |
| * 1. Apply Power Series
 | * Taylor’s Theorem
* McLaurin’s theorem
 | * Written tests
* Observation
* Oral questions
* Third party report
* Interviews
 |
| * 1. Apply Statistics
 | * Measures of central tendency and dispersion
* Laws of probability
* Probability distributions
* Data analysis
* Sampling distribution, T-distribution and Estimation
 | * Written tests
* Observation
* Oral questions
* Third party report
* Interviews
* Projects
 |
| * 1. Apply Numerical methods
 | * Roots of polynomials
* Iterations
* Interpolation and extrapolation
 | * Written tests
* Observation
* Oral questions
* Third party report
* Interviews
 |
| * 1. Apply Vector theory
 | * Vectors and scalar
* Operations on vectors
* Position of vectors
* Resolution of vectors
 | * Written tests
* Observation
* Oral questions
* Third party report
* Interviews
 |
| * 1. Apply Matrix
 | * Determinant and inverse
* Solutions of simultaneous equations
* Eigen values and Eigen vectors
 | * Written tests
* Observation
* Oral questions
* Third party report
* Interviews
 |

**Suggested methods of Instruction**

* Direct instruction
* Demonstrations
* Group discussion
* Presentations
* Videos
* Assignments
* Role play
* Question and answer
* Modelling

**Recommended Resources**

* Computers
* Stationery
* Charts/posters/
* Publications
* Video clips
* LCD projector
* Scientific calculators

## CHEMISTRY PRINCIPLES

**UNIT CODE:** MIN/CU/MT/CC/03/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Apply Chemistry Principles

**Duration of Unit:** 105 hours

**Unit Description**

This unit covers the competencies required by a Mining Technician in order to apply inorganic chemistry, organic chemistry, analytical and physical chemistry in the workplace.

**Summary of Learning Outcomes**

1. Apply inorganic chemistry
2. Apply organic chemistry
3. Apply physical chemistry
4. Apply analytical chemistry

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Apply inorganic chemistry
 | * Geochemical Fundamentals
* Matter
* Isotope Geochemistry
* Atomic Structure And Bonding
* The Periodic Table
* Chemistry of Transition Elements
* Minerals and Ores
* Radioactivity and Nuclear Chemistry
 | * Written tests
* Observation
* Oral questions
* Assignment
* practical’s
 |
| 1. Apply organic chemistry
 | * Organic compounds
* Organic compounds Classifications and their nomenclature
* Biologically important organic compounds
* Organic compounds and living organisms
* Distribution of organic compounds in water and soils
* Geochemical properties of organic compounds and their role as complexing agents and adsorbent
* Sedimentary Organic Matter, Coal and Oil Formation
* Carbon cycles and climate
 | * Written tests
* Observation
* Oral questions
* Assignment
* practical’s
 |
| 1. Apply physical chemistry
 | * Chemical and Ionic Equilibrium
* Acids and Bases
* Redox Potential and its Application.
* Aqueous chemistry
 | * Written tests
* Observation
* Oral questions
* Assignment
* practical’s
 |
| 1. Apply analytical chemistry
 | * geochemical analytical techniques
* Separation Methods
* Bulk (whole rock) chemical techniques
 | * Written tests
* Observation
* Oral questions
* Assignment
* practical’s
 |

**Suggested Methods of Instruction**

* Direct instruction
* Demonstrations
* Group discussion
* Presentations
* Videos
* Assignments
* Role play
* Question and answer
* Modelling

**Recommended Resources**

* Computers
* Stationery
* Charts/posters/
* Publications
* Video clips
* LCD projector
* Chemicals
* Apparatus
* Equipment
* Reagents
* PPES
	+ - Gloves
		- Gas mask
		- Lab coat
		- Closed leather shoes
		- Goggles

## PHYSICS PRINCIPLES

**UNIT CODE:** MIN/CU/MT/CC/04/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Apply physics principles

**Duration of Unit:** 100 hours

**Unit Description**

This unit describes the competencies required by a Mining technician in order to apply a wide range of physics principles in their work. It includes applying principles of: the concept of basic quantities of measurement, mechanics, acoustics, thermodynamics, optics, electromagnetism, current electricity, basic electronics and modern physics

**Summary of Learning Outcomes**

1. Apply the concept of basic quantities of measurement
2. Apply principles of mechanics
3. Apply principles of thermodynamics
4. Apply principles of optics
5. Apply principles of electromagnetic theory
6. Apply principles of current electricity
7. Apply principles of basic electronics
8. Apply principles of modern physics

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Apply the concept of basic quantities of measurement
 | * Phases of matter
* Dimensions of space
* Nature and properties of matter
* Parameters of measurement
* Concept of time
 | * Written tests
* Observation
* Oral questions
* Third party report
* Interviews
 |
| 1. Apply principles of mechanics
 | * Vectors and forces
* Statics
* Kinematics
* Machines
* Acoustics and waves
 | * Written tests
* Observation
* Oral questions
* Third party report
* Interviews
 |
| 1. Apply principles of thermodynamics
 | * Temperature scales
* Modes and rates of heat transfer
* Laws of thermodynamics
 | * Written tests
* Observation
* Oral questions
* Third party report
* Interviews
 |
| 1. Apply principles of optics
 | * Production and nature of light
* Ray optics
* Wave aspects of light
* Absorption, scattering, transmission and polarization of light
 | * Written tests
* Observation
* Oral questions
* Third party report
* Interviews
 |
| 1. Apply principles of electromagnetic theory
 | * Electrostatics
* Magnetism
* Electromagnetism
* Maxwell’s equations
* Electromagnetic waves and spectrum
 | * Written tests
* Observation
* Oral questions
* Third party report
* Interviews
 |
| 1. Apply principles of current electricity
 | * Sources of electromotive force
* Basic electric circuits
* Direct Current (D.C.) transients
* Alternating Current (A.C)
* Basic electrical appliances
 | * Written tests
* Observation
* Oral questions
* Third party report
* Interviews
 |
| 1. Apply principles of basic electronics
 | * Semiconductor materials and the band theory
* Types of conduction
* Doping
* Semiconductor chips
* Biasing principles.
 | * Written tests
* Observation
* Oral questions
* Third party report
* Interviews
 |
| 1. Apply principles of modern physics
 | * Principles of relativity
* Atomic and nuclear physics
* Wave mechanics
* Schrödinger equations
* Principles of Particle physics
 | * Written tests
* Observation
* Oral questions
* Third party report
* Interviews
 |

**Suggested Methods of Instruction**

* Direct instruction
* Demonstrations
* Group discussion
* Presentations
* Videos
* Assignments
* Role play
* Question and answer
* Modelling

**Recommended Resources**

* Computers
* Stationery
* Charts/posters/
* Publications
* Video clips
* LCD projector
* Apparatus
* Lab
* Equipment
* PPES
	+ - Gloves
		- Lab coat
		- Closed leather shoes
		- Goggles

## RESEARCH METHODS

**UNIT CODE:** MIN/CU/MT/CC/05/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Conduct Research

**Duration of Unit:** 85 hours

**Unit Description**

This unit covers the competencies required to conduct research. It involves developing research proposal, collecting research data, analysing research data and preparing research report.

**Summary of Learning Outcomes**

1. Develop research proposal
2. Develop research budget proposal and work plan
3. Collect research data
4. Analyse research data
5. Prepare research report

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Develop research proposal
 | * Terms and concepts
* Importance of research
* Ethics in research
* Scientific research process
* Types of research
* Importance of research proposal
* Types of research proposal
* Format of academic research proposal
* Format of a commercial research proposal.
* Qualities of a good research problem
* Identification of research problem
* Formulation of research title
* Research proposal writing
	+ Background information of the study
	+ Formulation of research objectives
	+ Research questions
	+ Research hypothesis
	+ Statement of research problem
	+ Purpose of research study
	+ Significance of research study
	+ Limitation of research study
	+ Scope of research study
	+ Definition of terms
	+ Abbreviations and acronyms
* Review of related literature
	+ Purpose of review
	+ Sources of literature
	+ Style of presentation
* Research methodology
	+ Research design
	+ Population of study
	+ Sample and sampling techniques
	+ Types of data collection tools
	+ Development of data collection tools
	+ Procedure for data collection
	+ Data analysis plan
 | * Written tests
* Oral questions
* Third party report
* Presentation
 |
| 1. Develop research budget proposal and work plan
 | * Budgeting
* Direct cost
* Indirect cost
* Factors to consider when costing

Development of work plan E.g. Gant chart | * Written tests
* Oral questions
* Third party report
* Presentation
 |
| 1. Collect research data
 | * Terms and concepts
* Methods of data collection and their limitations
* Piloting of data collection tools
* Collection of data
* Collation of data
 | * Written tests
* Oral questions
* Third party report
* Presentation
 |
| 1. Analyse and process research data
 | * Data handling
* Data analysis
	+ Quantitative
	+ Qualitative
* Data processing
	+ Validation
	+ Editing
	+ Coding
	+ Tabulation
* Data presentation and interpretation
* Conclusion and recommendations
 | * Written tests
* Oral questions
* Third party report
* Presentation
 |
| 1. Present research findings
 | * Compiling and writing of Research report
* Editing research report
* Sharing of research report
* Dissemination of research finding
* References
 | * Written tests
* Oral questions
* Third party report
* Presentation
 |

**Suggested Methods of Instruction**

* Direct instruction
* Demonstrations
* Group discussion
* Presentations
* Videos
* Assignments
* Role play
* Question and answer

**Recommended Resources**

* Internet connectivity
* Computers
* Library
* Stationery
* Charts/posters/
* Publications
* Video clips
* LCD projector
* Tools and equipment

# CORE UNITS OF LEARNING

## MINE DESIGN AND PLANNING

**UNIT CODE:** MIN/CU/MT/CR/01/6/A

**Relationship to Occupational Standards**

This unit of learning addresses the Unit of Competency: Develop Mine Design

**Duration of Unit:** 160hours

**Unit Description**

This unit specifies competencies required to develop mine design. It entails developing mineral block model, determining mine plant, equipment and workforce, designing: mine ventilation system, dewatering system, mine haulage and access infrastructure, mine crushing unit, tailing dams and stockpiles. It also involves preparing a schematic mine layout.

**Summary of Learning Outcomes**

1. Develop mineral block model
2. Determine mine plant and equipment
3. Determine mine workforce
4. Design mine ventilation system
5. Design mine dewatering system
6. Design mine haulage infrastructure
7. Design mine crushing unit
8. Design mine access infrastructure
9. Prepare schematic mine layout
10. Design tailing dams
11. Design mine stockpiles

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Develop mineral block model
 | * Terms and concepts
* Basic geology
* Sectioning and Digitizing
* Compositing
* Creating DTMs
* Ore analysis
* Application of mine software
* Surpac
* Datamine
* Netpro
* Maptek etc.
* Geostatistics
* Mineralization
 | * Observation checklist
* Oral questioning
* Written tests
* Practical’s
 |
| 1. Determine mine plant and equipment
 | * Mining tools and equipment
* Mining methods
* Mineral Processing methods
* Plant layout
* Mineral processing equipment
 | * Oral questions
* Assignments
* Presentations
* Written tests
 |
| 1. Determine mine workforce
 | * Long term mine plans
* Life of mine
* 25-year plan
* 5-year plan
* Short term mine plans
* Annual plan
* Production scheduling
* Daily schedule
* Weekly schedule
* Monthly schedule
 | * Assignments
* Presentations
* Written tests
* Practicals
 |
| 1. Design mine ventilation system
 | * Air flow in mines
* Ventilation control devices
* Mine ventilation circuit and networks
* Refrigeration in mines
* Natural ventilation
* Ventilation by fans etc.
* ISO4001 Standard conventions
* Ventilation systems
* Fan types
* Main fans
* Auxiliary fans
* Booster fans etc.
 | * Assignments
* Presentations
* Written tests
* Practicals
 |
| 1. Design mine dewatering system
 | * Source of mine water
* Types of pumps
* Centrifugal
* Piston
* pneumatic
* Submersible pump
* Air lift pumps
* Test pumping
* Mine dewatering techniques
* Dewatering by pumping
* Dewatering by exclusion
* Dewatering by depressurization etc.
 | * Assignments
* Presentations
* Written tests
* Practicals
 |
| 1. Design mine haulage infrastructure
 | * Types of haul roads
* Hoisting system
* Friction hoist
* Drum hoist
* Blair multi rope hoist
* Haul road geometry
* Entry system
* Single entry
* Double entry
* Triple entry
* Spiral entry
* Switch back entry etc.
* Haulage equipment
* Conveyor belts
* Front end loaders
* Trucks
* Autonomous trucks
* Load haul dump etc.
 | * Assignments
* Presentations
* Written tests
* Practicals
 |
| 1. Design mine crushing unit
 | * Types of crushers
* Screens
* Vibration screens
* Static screens
* Trommels
* Roller screens etc.
* Geotechnical properties
* Particle size distribution
* Hardness
* Grain size
* Compressibility
* Shear strength
* Tensile strength
* Power ratings
 | * Assignments
* Presentations
* Written tests
* Practicals
 |
| 1. Design mine access infrastructure
 | * Types of haul roads
* Hoisting system
* Friction hoist
* Drum hoist
* Blair multi rope hoist
* Entry system
* Locomotives
* Rail
* Mine illumination
 | * Assignments
* Presentations
* Written tests
* Practicals
 |
| 1. Prepare schematic mine layout
 | * Basic photogrammetry
* Satellite imaging
* Mapping software
* ERDAS
* ArcGIS
* QGIS
* Mine layout designs
* Location of TSF
* Location of Residential camps
* Location of Processing plants
* Location of stockpiles
* Location of power plant
* Location of water treatment plant
 | * Assignments
* Presentations
* Written tests
* Practicals
 |
| 1. Design tailing dams
 | * Types of tailing materials
* Environmental impacts of tailing dams
* Mineral processing methods
* Cynadation
* Froth flotation
* Magnetic separation
* Milling
* Pressure leaching etc.
* Tailing dams design
* Tailing dam closure strategy
 | * Assignments
* Presentations
* Written tests
* Practicals
 |
| 1. Design mine stockpiles
 | * Waste rock stockpiles
* Ore stockpiles
* Low grade
* High grade
* Mine waste management
* Geotechnical properties
 | * Assignments
* Presentations
* Written tests
* Practicals
 |

**Suggested Methods of Instruction**

* Facilitation of theory by trainer
* Field trips
* Demonstration of task by trainer
* Practice by trainee

**Recommended Resources**

* Personal Protective Equipment
* Software’s
* Computers
* Stationery
* White board
* Samples
* Reagents
* Geological data
* Equipment

## MINE HEALTH, SAFETY AND ENVIRONMENT

**UNIT CODE:** MIN/CU/MT/CR/02/6/A

**Relationship to Occupational Standards**

This unit of learning addresses the Unit of Competency: Manage Mine Health, Safety and Environment.

**Duration of Unit:** 100hours

**Unit Description**

This unit specifies competencies required to manage mine Health, Safety and Environment. It entails holding safety brief meetings, providing safety equipment, evacuating the mine, sensitizing the community, controlling environmental pollution, building staff capacity, monitoring community health and rehabilitating mine site environment.

**Summary of Learning Outcomes**

1. Hold safety briefs meetings
2. Provide safety equipment
3. Evacuate the mine
4. Sensitize the community
5. Control environmental pollution
6. Build staff capacity
7. Monitor community’s health
8. Rehabilitate mine site environment

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Hold safety briefs meetings
 | * Safety organisation and regulations
* Safe work practices and conditions
* Quality management system
* Comprehensive mine safety programs
 | * Observation
* Oral questioning
* Written tests
* Practical tests
 |
| 1. Provide safety equipment
 | * Mine risks and hazards
* Safety equipment’s and PPEs
 | * Observation
* Oral questioning
* Product checklist
 |
| 1. Evacuate the mine
 | * Mining methods
* Evacuation tools and equipment
* Emergency management training
* Mine accidents
* Safety drills
 | * Observation
* Oral questioning
* Written tests
* Practical tests
 |
| 1. Sensitize the community
 | * Safety regulations
* Mine risks and hazards
 | * Observation
* Product checklist
* Oral questioning
* Written test
 |
| 1. Control environmental pollution
 | * Terms and concepts
* Baseline
* Mine waste
* Water use and quality
* Air quality
* Noise and vibrations
* Mine closure and post closure activities
* Environmental impacts of pollution
 | * Written tests
* Presentation
* Oral questioning
* Assignment
 |
| 1. Build staff capacity
 | * Principles of management
* Staff safety sensitization
* Staff motivation
* Addressing staff issues
* Capacity building
 | * Written tests
* Presentation
* Oral questioning
* Assignment
 |
| 1. Monitor community’s health
 | * Mine diseases
* Causes of mine diseases
* Exposure
* Type of exposures
* Ways of controlling exposures
* Design of monitoring exposure and assessment programs
* Health and safety regulations
 | * Written tests
* Presentation
* Oral questioning
* Assignment
 |
| 1. Rehabilitate mine site environment
 | * Mine rehabilitation and reclamation aspects
* Afforestation
* Backfilling
* Water treatment
* Environmental impacts of mine waste
 | * Written tests
* Presentation
* Oral questioning
* Assignment
 |

**Suggested Methods of Instruction**

* Facilitation of theory by trainer
* Demonstration of task by trainer
* Practice by trainee
* Industrial visits
* Field trips

**Recommended Resources**

* Personal Protective Equipment
* Computers
* Stationery
* White board
* Equipment
* Software
* Internet connectivity

## DRILLING AND BLASTING

**UNIT CODE:** MIN/CU/MT/CR/03/6/A

**Relationship to Occupational Standards**

This unit of learning addresses the Unit of Competency: Manage Drilling and Blasting Operations

**Duration of Unit:** 130 hours

**Unit Description**

This unit specifies competencies required to manage drilling and blasting operations. It entails developing blast design, executing drilling operations and carrying out blasting operations to ensure mine operations are smoothly run.

**Summary of Learning Outcomes**

1. Develop blast design
2. Execute drilling operation
3. Carry out blasting operation

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Develop blast design
 | * Terms and Concepts
* Design of a blast
* Drilling equipment
* Blasting equipment
* Explosives
* Drilling and blasting procedure
* Legal aspects in blasting
 | * Observation
* Oral questioning
* Written tests
* Practicals
 |
| 1. Execute drilling operation
 | * Terms and concept
* Drilling program
* Drilling equipment and accessories
* Drilling methods
* Drilling patterns
* Geotechnical aspects in drilling
* Drilling monitoring
* HSE
 | * Observation
* Product checklist
* Oral questioning
* Practicals
 |
| 1. Carry out blasting operation
 | * Blasting terminologies
* Explosives and Blasting materials
* Blasting equipment
* Blasting procedure
* Explosive handling
* Blasting regulations
 | * Observation
* Oral questioning
* Written tests
* Practicals
 |

**Suggested Methods OF Instruction**

* Fieldtrips
* Facilitation of theory by trainer
* Demonstration of task by trainer
* Practice by trainee

**Recommended Resources**

* Personal Protective Equipment
* Internet connectivity
* Explosives and blasting materials
* Blasting equipment
* Drilling equipment
* Computers
* Stationery
* White board
* Software
* Relevant instruction manuals

## LOADING AND HAULAGE IN MINES

**UNIT CODE:** MIN/CU/MT/CR/04/6/A

**Relationship to Occupational Standards**

This unit of learning addresses the unit of competency: Manage loading and haulage operations

**Duration of Unit:** 120 hours

**Unit Description**

This unit specifies competencies required to manage loading and hauling operations. It entails providing loading and hauling equipment, maintaining loading and hauling equipment and records and monitoring loading and hauling operations. These operations are critical in the mining industry.

**Summary of Learning Outcomes**

1. Provide loading and hauling equipment
2. Maintain loading and hauling equipment and records
3. Monitor loading and hauling operation

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Provide loading and hauling equipment
 | * Mining method
* Loading equipment
* haulage systems
* Basic mechanics
* Basic wiring
 | * Observation
* Oral questioning
* Written tests
* Assignment
* Practical
 |
| 1. Maintain loading and hauling equipment and records
 | * Terms and Concepts
* Record keeping
* Fleet management
* Equipment servicing and maintenance
 | * Observation
* Oral questioning
* Written tests
* Assignments
* Practicals
 |
| 1. Monitor loading and hauling operation
 | * Terms and concepts
* Loading and haulage equipment
* Loading and haulage systems safety
* Loading and haulage operation incidents and accidents records
 | * Observation
* Oral questioning
* Written tests
* Assignments
* Practical
 |

**Suggested Methods of Instruction**

* Facilitation of theory by trainer
* Demonstration of task by trainer
* Practice by trainee
* Viewing videos of loading and haulage systems
* Viewing mine transport simulations
* Mine visits

**Recommended Resources**

* Personal Protective Equipment
* Computer
* Computer Software
* Workshops

## ORE CRUSHING OPERATION

**UNIT CODE:** MIN/CU/MT/CR/05/6/A

**Relationship to Occupational Standards**

This unit of learning addresses the Unit of Competency; Manage Ore Crushing Operation

**Duration of Unit:** 100hours

**Unit Description**

This unit specifies competencies required to manage ore crushing operations in the mining industry. It entails providing ore crushing equipment, maintaining: ore samples, crushing equipment and records. It also involves monitoring ore crushing operations which ensure mine operations go uninterrupted.

**Summary of Learning Outcomes**

1. Provide ore crushing equipment.
2. Maintain ore crushing equipment records
3. Monitor ore crushing operations
4. Maintain Ore samples

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Provide ore crushing equipment.
 | * Terms and concepts
* Mineral Processing method
* Ore crushing equipment
* Screen
* Vibration screens
* static Screens etc
* Geotechnical properties of rocks
 | * Observation
* Oral questioning
* Written tests
* Assignments
 |
| 1. Maintain ore crushing equipment and records
 | * Ore crushing equipment servicing and maintenance
* Crushing record keeping
* Basic mechanical and wiring skills
* Maintenance schedule
 | * Observation
* Written test
* Oral questioning
* Practicals
* Assignments
 |
| 1. Monitor ore crushing operations
 | * Ore crushing equipment
* Mineral processing method
* Crushing operation assessment procedure
 | * Observation
* Oral questioning
* Written tests
* Assignments
 |
| 1. Maintain Ore samples
 | * Terms and concepts
* Sample Identification
* Sampling techniques
* Laboratory practices
* Sample record keeping
 | * Observation
* Written tests
* Oral questioning
* Assignment
 |

**Suggested Methods of Instruction**

* Trainer led facilitation of Ore crushing operations
* Demonstration of task by trainer
* Practice by trainee
* Field visits
* Viewing videos of crushing operation

**Recommended Resources**

* Personal Protective Equipment
* Safety goggles
* Overall
* Safety boots
* Gloves
* Ear plugs
* Workshops
* Tools and equipment
* Samples
* Crushing operations videos
* Reference materials

## MINE GROUND STABILIZATION

**UNIT CODE:** MIN/CU/MT/CR/06/6/A

**Relationship to Occupational Standards**

This unit of learning addresses the Unit of Competency: Manage Mine Ground Stabilization

**Duration of Unit:** 110hours

**Unit Description**

This unit specifies competencies required to manage mine ground stabilization. It entails providing ground stabilizing operation equipment and monitoring ground stabilizing operations. This ensures the ground is stable for safe mine operations.

**Summary of Learning Outcomes**

1. Provide ground stabilizing operation equipment
2. Monitor ground stabilizing operations

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Provide ground stabilizing operation equipment
 | * Terms and concepts
* Mining Methods
* Geotechnical properties of rock
* Rock and Soil mechanics
* Ground support methods
* Ground support and stability equipment
* Ground support materials
 | * Observation
* Written tests
* Oral questioning
* Assignments
 |
| 1. Monitor ground stabilizing operations
 | * Mining Methods
* Geotechnical properties of rock
* Rock and Soil mechanics
* Slope stability
* Deformation monitoring
* Ground stabilizing monitoring records
 | * Observation
* Written tests
* Oral questioning
* Practical tests
 |

**Suggested Methods of Instruction**

* Trainer led facilitation
* Demonstration of task by trainer
* Practice by trainee
* Field visits
* Viewing videos of ground support

**Recommended Resources**

* Measuring and checking tools
* Marking out tools
* Computers
* Softwares
* Design laboratories
* Survey equipments
* Total station
* Leveling machine
* Theodolite
* GPS

## MINE FLUID MANAGEMENT

**UNIT CODE:** MIN/CU/MT/CR/07/6/A

**Relationship to Occupational Standards**

This unit of learning addresses the unit of competency: Manage mine fluid flow

**Duration of Unit:** 120hours

**Unit Description**

This unit specifies competencies required to manage mine fluid flow. It entails establishing the following: Mine ventilation system, mine dewatering system and mine degasification system. This ensures the ore is exhaustively mined without unnecessary fluid interference.

**Summary of Learning Outcomes**

* + - 1. Establish Mine Ventilation System.
			2. Establish Mine Dewatering System
			3. Establish Mine Degasification System.

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Establish Mine Ventilation System
 | * Terms and concepts
* Mining Methods
* Mine hazards
* Types of ventilation
* Ventilation control devices
* Type of fans
* Fan laws
 | * Observation
* Written tests
* Oral questioning
* Assignments
* Demonstrations
 |
| 1. Establish Mine Dewatering System
 | * Terms and concepts
* Mining methods
* Mine layout
* Sources of mine water
* Dewatering equipment
* Types of pumps
* Mine drainage systems
* Test pumping
 | * Observation
* Written tests
* Oral questioning
* Practical tests
 |
| 1. Establish Mine Degasification System.
 | * Terms and concepts
* Mining methods
* Mine layout
* Mine gas classification
* Strata gases
* Unscheduled occurrence gas
* Mining and metal recovery gases
* Gas mixtures
* Methane drainage
* Drainage wells
* Gas detection and monitoring
* Degasification equipment
* Effects of mine gases
 | * Observation
* Written tests
* Oral questioning
* Practical tests
 |

**Suggested Methods of Instruction**

* Trainer led facilitation
* Demonstration of task by trainer
* Practice by trainee
* Field visits
* Viewing videos of ventilation and dewatering system

**Recommended Resources**

* Computers
* Softwares
* Design laboratories
* Pumps
* Fans
* Reference materials
* Stationery
* Membrane
* Strain tubes
* Thermal conductivity and acoustic detectors
* Mass spectrometers
* Paramagnetic analysers

## MINE SURVEY

**UNIT CODE:** MIN/CU/MT/CR/08/6/A

**Relationship to Occupational Standards**

This unit of learning addresses the Unit of Competency: Perform Mine Survey

**Duration of Unit:** 130hours

**Unit Description**

This unit specifies competencies required to perform mine survey. It entails conducting the following; Mine reconnaissance, hydrographic survey, traversing and levelling operations. It also involves interpreting contour maps. Performing mine survey is critical in the mining industry.

**Summary of Learning Outcomes**

1. Conduct mine reconnaissance
2. Conduct hydrographic survey
3. Conduct traversing operations
4. Conduct levelling operations
5. Interpret contour maps

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Conduct mine reconnaissance
 | * Terms and concepts
* Principles of survey
* Types of survey
* Cadastral
* Topographical
* Hydrographic
* Geodetic
* Photogrammetry
* Importance of reconnaissance survey
* Survey equipment
 | * Observation
* Practical
* Written tests
* Oral questioning
* Assignments
* Demonstrations
 |
| 1. Conduct hydrographic survey
 | * Terms and concepts
* Maritime Zones
* Control points
* Coordinate reference systems
* Types and sources of errors
* Corrections
* Safety measures
* Hydrographic Survey equipment
 | * Observation
* Written tests
* Oral questioning
* Practical tests
 |
| 1. Conduct traversing operations
 | * Terms and concepts
* Transfer of horizontal control
* Errors and sources of errors
* Corrections
* Compass traversing
* Open and closed traversing
* Methods of plotting a traverse
 | * Observation
* Written tests
* Oral questioning
* Practical tests
 |
| 1. Conduct levelling operations
 | * Terms and concepts
* Datum
* Benchmark
* Reduced level
* Back sight
* Foresight
* Intermediate sight
* Change point
* Types of levels
* Types of levelling staffs
* Reduction of levels
* Rise and fall
* Height of collimation
* Levelling types
* Simple
* Differential
* Fly
* Profile
* Reciprocal
* Errors in levelling
 | * Observation
* Written tests
* Oral questioning
* Practical tests
 |
| 1. Interpret contour maps
 | * Contour maps
* Methods of contouring
* Methods of interpolation of controls
* Study of toposheets
 | * Observation
* Written tests
* Oral questioning
* Practical tests
 |

**Suggested Methods of Instruction**

* Trainer led facilitation
* Demonstration of task by trainer
* Practice by trainee
* Field visits
* Viewing videos

**Recommended Resources**

* Computers
* Reference materials
* Topographic maps
* Survey equipment
* Total station
* GPS
* Theodolite
* Levels
* RTK
* Booking sheet
* Survey software
* ArcGIS
* Surfers
* Esurvey CAD
* Reference materials.
* Stationery.