

**NATIONAL OCCUPATIONAL STANDARDS**

**FOR**

**MINING TECHNICIAN**

**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 blue print 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 these Occupational Standards were developed for the purpose of developing a competency-based curriculum for Mining Technology Level 6. These Occupational Standards will also be the bases for assessment of an individual for competence certification.

It is my conviction that these Occupational Standards will play a great role towards development of competent human resource for the Mining sector’s growth and sustainable development.

**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 and the Sessional Paper No. 4 of 2016 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.

The TVET Curriculum Development, Assessment and Certification Council (TVET CDACC), in conjunction with Energy Sector Skills Advisory Committee (SSAC), have developed these Occupational Standards for a Mining Technician. These occupational standards will be the bases for development of competency-based curriculum Mining technology Level 6. These Standards will also be the bases for assessment of an individual for competence certification.

The occupational standards are designed and organized with clear performance criteria for each element of a unit of competency. These standards also outline the required knowledge and skills as well as evidence guide.

I am grateful to the Council Members, Council Secretariat, Energy and extractives SSAC, expert workers and all those who participated in the development of these occupational standards.

**CHAIRPERSON,**

**TVET CDACC**

# ACKNOWLEDGEMENT

These Occupational Standards were developed through combined effort of various stakeholders from private and public organizations. I am sincerely thankful to the management of these organizations for allowing their staff to participate in this course. I wish to acknowledge the invaluable contribution of industry players who provided inputs towards the development of these Standards.

I thank TVET Curriculum Development, Assessment and Certification Council (TVET CDACC) for providing guidance on the development of these Standards. My gratitude goes to the Energy and extractives Sector Skills Advisory Committee (SSAC) members for their contribution to the development of these Standards. I thank all the individuals and organizations who participated in the validation of these Standards.

I acknowledge all institutions which in one way or another contributed to the development of these Occupational Standards.

**CHAIRPERSON**

**ENERGY AND EXTRACTIVES SECTOR SKILLS ADVISORY COMMITTEE**

# ABBREVIATION AND ACRONYMNS

BC Basic Competency

CBET Competency Based Education and Training

CC Common Competency

CDACC Curriculum Development Assessment and Certification Council

CR Core Competency

EMCA Environmental Management and Coordination Act

MoE Ministry of Education

NGO Non-Governmental Organization

OS Occupational Standards

OSHA Occupation Safety and Health Act

PPE Personal Protective Equipment

SSAC Sector Skills Advisory Committee

TVET CDACC TVET Curriculum Development Assessment and Certification Council

TVET Technical and Vocational Education and Training

# KEY TO UNIT CODE

MIN /OS /MT/BC /01/ 6/ A

Industry or sector

Occupational Standards

Occupational area

Type of competency

Competency number

Competency level

Version control

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**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

The units of competency comprising this qualification include the following basic, common and core competencies:

**Basic Units of Competency**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| MIN/OS/MT/BC/01/6/A | Demonstrate communication skills |
| MIN/OS/MT/BC/02/6/A | Demonstrate digital literacy |
| MIN/OS/MT/BC/03/6/A | Demonstrate entrepreneurial skills |
| MIN/OS/MT/BC/04/6/A | Demonstrate employability skills |
| MIN/OS/MT/BC/05/6/A | Demonstrate environmental literacy |
| MIN/OS/MT/BC/06/6/A | Demonstrate occupational safety and health practices |

**Common Units of Competency**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| MIN/OS/MT/CC/01/6/A | Prepare and interpret technical drawings |
| MIN/OS/MT/CC/02/6/A | Apply mathematics principles |
| MIN/OS/MT/CC/03/6/A | Apply chemistry principles |
| MIN/OS/MT/CC/04/6/A | [Apply](#_Toc525316851) physics principles |
| MIN/OS/MT/CC/05/6/A | Conduct research |

**Core Units of Competency**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| MIN/OS/MT/CR/01/6/A | Develop mine design |
| MIN/OS/MT/CR/02/6/A | Manage mine HSE |
| MIN/OS/MT/CR/03/6/A | Manage drilling and blasting |
| MIN/OS/MT/CR/04/6/A | Manage loading and haulage |
| MIN/OS/MT/CR/05/6/A | Manage ore crushing operations |
| MIN/OS/MT/CR/06/6/A | Manage mine ground stabilization |
| MIN/OS/MT/CR/07/6/A | Manage mine fluid flow |
| MIN/OS/MT/CR/08/6/A | Perform mine survey |

# BASIC UNITS OF COMPETENCY

## DEMONSTRATE COMMUNICATION SKILLS

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

**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.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Meet communication needs of clients and colleagues | 1. Specific communication needs of clients and colleagues are identified and met based on workplace requirements 2. Different communication approaches are identified and applied according to clients’ needs 3. Conflict is identified and addressed as per the standards of the organization |
| 1. Develop communication strategies | * 1. Strategies for effective internal and external dissemination of information are developed as per organization’s requirements   2. Special communication needs are considered in developing strategies according workplace procedures   3. ***Communication strategies*** are analyzed, evaluated and revised based the workplace needs |
| 1. Establish and maintain communication pathways | * 1. Pathways of communication are established as per organization policy   2. Pathways are maintained and reviewed according to organization procedures |
| 1. Promote use of communication strategies | * 1. Information is provided to all areas of the organization as per strategy requirements   2. Effective communication techniques are articulated and modeled according work requirements   3. Personnel are given guidance about adapting communication strategies as per organization procedures |
| 1. Conduct interview | 1. A range of appropriate communication strategies are employed in ***interview situations*** based on the workplace requirements 2. Records of interviews are made and maintained in accordance with organizational procedures 3. Effective questioning, listening and nonverbal communication techniques are used as per needs |
| 1. Facilitate group discussion | 1. Mechanisms to enhance ***effective group interaction*** are identified and implemented according to workplace requirements 2. Strategies to encourage group participation are identified and used as per organizations’ procedures 3. Meetings objectives and agenda are set and followed based on workplace requirements 4. Relevant information is provided and feedback obtained according to set protocols 5. Evaluation of group communication strategies is undertaken in accordance with workplace guidelines 6. Specific communication needs of individuals are identified and addressed as per individual needs |
| 1. Represent the organization | 1. 7Relevant presentation are researched and presented based on internal or external communication forums requirements 2. Presentation is delivered in a clear and sequential manner as per the predetermined time 3. Presentation is made as per appropriate media 4. Difference views are respected based on workplace procedures 5. Written communication is done as per organizational standards 6. Inquiries are responded according to organizational standard |

**RANGE**

This section provides work environment and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Communication strategies may include but not limited to: | * Language switch * Comprehension check * Repetition * Asking confirmation * Paraphrase * Clarification request * Translation * Restructuring * Approximation * Generalization |
| 1. Effective group interaction may include but not limited to: | * Identifying and evaluating what is occurring within an interaction in a nonjudgmental way * Using active listening * Making decision about appropriate words, behavior * Putting together response which is culturally appropriate * Expressing an individual perspective * Expressing own philosophy, ideology and background and exploring impact with relevance to communication |
| 1. Situations may include but not limited to: | * Establishing rapport * Eliciting facts and information * Facilitating resolution of issues * Developing action plans * Diffusing potentially difficult situations |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Communication
* Active listening
* Interpretation
* Negotiation
* Writing

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Communication process
* Dynamics of groups
* Styles of group leadership
* Key elements of communications strategy

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   1. Developed communication strategies to meet the organization requirements and applied in the workplace 2. Established and maintained communication pathways for effective communication in the workplace 3. Used communication strategies involving exchanges of complex oral information |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace or appropriately simulated environment where assessment can take place 2. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Direct observation 2. Oral questioning 3. Written texts |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## DEMONSTRATE NUMERACY SKILLS

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

**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.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms*** ***are elaborated in the Range.*** |
| 1. Apply a wide range of mathematical calculations for work | * 1. Mathematical information embedded in a range of workplace tasks and texts is extracted as per workplace procedures.   2. Mathematical information is interpreted and comprehended as per job specifications   3. A range of mathematical and problem solving processes are selected and used as per job specification   4. Different forms of fractions, decimals and percentages are flexibly used as per SOPs   5. Calculation performed with positive and negative numbers as per SOPs   6. Numbers are expressed as powers and roots and are used in calculations as per SOPs   7. Calculations done using routine formulas as per SOPs   8. Estimation and assessment processes are used to check outcome as per workplace procedures   9. Mathematical language is used to discuss and explain the processes, results and implications of the task as per workplace procedures |
| 1. Use and apply ratios, rates and proportions for work | * 1. Information regarding ratios, rates and proportions extracted from a range of workplace tasks and texts as per SOPs   2. Mathematical information related to ratios, rate and proportions is analysed as per SOPs   3. Problem solving processes are used to undertake the task as per workplace procedures   4. Equivalent ratios and rates are simplified as per SOPs   5. Quantities are calculated using ratios, rates and proportions as per SOPS   6. Graphs, charts or tables are constructed to represent ratios, rates and proportions as per SOPs   7. The outcomes reviewed and checked as per job specifications   8. Information is record using mathematical language and symbols as per workplace procedures |
| 1. Estimate, measure and calculate measurement for work | * 1. Measurement information embedded in workplace texts and tasks are extracted and interpreted as per job specifications   2. Appropriate workplace measuring equipment are identified and selected as per job specifications   3. Accurate measurements are estimated and made as per SOPs   4. The area of ***2D shapes*** including compound shapes is calculated as per SOPs   5. The volume of 3D shapes is calculated using relevant formulas as per SOPs   6. Sides of right-angled triangles are calculated using Pythagoras’ theorem as per SOPs   7. conversions are performed between units of measurement as per job specification   8. Problem solving processes are used to undertake the task as per workplace Procedures   9. The measurement outcomes are reviewed and checked as per workplace procedures   10. Information is recorded using mathematical language and symbols appropriate for the task as per workplace procedures |
| 1. Use detailed maps to plan travel routes for work | * 1. Different types of maps are identified and interpreted as per job requirements   2. Key features of maps are identified as per job requirements   3. Scales are identified and interpreted as per job requirements   4. Scales are applied to calculate actual distances   5. Positions or locations are determined using directional information as per job requirements   6. Routes are planned by determining directions and calculating distances, speeds and times as per job requirements   7. Information is gathered and identified and relevant factors related to planning a route checked as per job requirements   8. Relevant equipment is select and checked for accuracy and operational effectiveness as per job requirements   9. Task is planned and recorded using specialized mathematical language and symbols appropriate for the task as per job requirements |
| 1. Use geometry to draw 2D shapes and construct 3D shapes for work | * 1. A range of 2D shapes and 3D shapes and their uses in work contexts is identified as per job specifications   2. Features of 2D and 3D shapes are named and described as per job specifications   3. Types of angles in 2D and 3D shapes are identified as per job specifications   4. Angles are drawn, estimated and measured using geometric instruments as per job requirements   5. Angle properties of 2D shapes are named and identified as per SOPs   6. Angle properties are used to evaluate unknown angles in shapes as per SOPs   7. Properties of perpendicular and parallel lines are applied to shapes as per SOPs   8. Understanding and use of symmetry is demonstrated as per SOPs   9. Understanding and use of similarity is demonstrated as per SOPs   10. The workplace tasks and mathematical processes required are identified as per workplace procedures   11. 2D shapes is drawn for work as per job specification   12. 3D shapes is constructed for work as per job specification   13. The outcomes are reviewed and checked as per workplace procedures   14. Specialized mathematical language and symbols appropriate for the task are used as per SOPs |
| 1. Collect, organize, and interpret statistical data for work | * 1. Workplace issue requiring investigation are identified as per workplace procedures   2. Audience / population / sample unit is determined as per workplace procedures as per workplace procedures   3. Data to be collected is identified as per workplace procedures   4. Data collection method is selected as per workplace procedures   5. Appropriate statistical data is collected and organized as per SOPs   6. Data is illustrated in appropriate formats as per SOPs   7. The effectiveness of different types of graphs are compared as per SOPs   8. The summary statistics for collected data is calculated as per SOPs   9. The results / findings are interpreted as per SOPs   10. Data is checked to ensure that it meets the expected results and content as per workplace procedures   11. Information from the results including tables, graphs and summary statistics is extracted and interpreted as per workplace procedure   12. Mathematical language and symbols are used to report results of investigation as per workplace procedure |
| 1. Use routine formula and algebraic expressions for work | * 1. Understanding of informal and symbolic notation, representation and conventions of algebraic expressions is demonstrated as per SOPs   2. Simple algebraic expressions and equations are developed as per job specification   3. Operate on algebraic expressions as per job requirement   4. Algebraic expressions are simplified as per job requirement   5. Substitution into simple routine equations is done as per SOPs   6. Routine formulas used for work tasks are identified and comprehended as per SOPs   7. Routine formulas are evaluated by substitution as per SOPs   8. Routine formulas transposed as per SOPs   9. Appropriate formulas are identified and used for work related tasks as per workplace procedures   10. Outcomes are checked and result of calculation used as per workplace procedures |
| 1. Use common functions of a scientific calculator for work | * 1. Required numerical information to perform tasks is located as per job specification   2. The order of operations and function keys necessary to solve mathematical calculation are determined as per job specification   3. Function keys on a scientific calculator are identified and used as per SOPs   4. Estimations are referred to check reasonableness of problem solving process as per workplace procedures   5. Appropriate mathematical language, symbols and conventions are used to report results as per workplace procedures |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. 2D shapes may include but not limited may include but not limited to: | * Triangles * Square * Rectangle * Triangle |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Measuring
* Logical thinking
* Computing
* Drawing of graphs
* Applying mathematical formulas
* Analytical

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Types of common shapes
* Differentiation between two dimensional shapes / objects
* Formulae for calculating area and volume
* Types and purpose of measuring instruments
* Units of measurement and abbreviations
* Fundamental operations (addition, subtraction, division, multiplication)
* Rounding techniques
* Types of fractions
* Different types of tables and graphs
* Meaning of graphs, such as increasing, decreasing, and constant value
* Preparation of basic data, tables & graphs

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   1. Developed communication strategies to meet the organization requirements and applied in the workplace 2. Established and maintained communication pathways for effective communication in the workplace 3. Used communication strategies involving exchanges of complex oral information |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace or appropriately simulated environment where assessment can take place 2. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Observation 2. Oral questioning 3. Written test 4. Portfolio of Evidence 5. Interview 6. Third party report |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## DEMONSTRATE DIGITAL LITERACY

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

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Identify appropriate computer software and hardware | * 1. Concepts of ICT are determined in accordance with computer equipment   2. Classifications of computers are determined in accordance with manufacturers specification   3. Appropriate computer software is identified according to manufacturer’s specification   4. Appropriate computer hardware is identified according to manufacturer’s specification   5. Functions and commands of operating system are determined in accordance with manufacturer’s specification |
| 1. Apply security measures to data, hardware, software in automated environment | * 1. ***Data security and privacy are classified*** in accordance with the prevailing technology   2. ***Security threats*** reidentified ***and control measures*** are applied in accordance with laws governing protection of ICT   3. Computer threats and crimes are detected in accordance to Information Management security guidelines   4. Protection against computer crimes is undertaken in accordance with laws governing protection of ICT |
| 1. Apply computer software in solving tasks | * 1. ***Word processing concepts*** are applied in resolving workplace tasks, report writing and documentation as per the job requirements   2. ***Word processing utilities*** are applied in accordance with workplace procedures   3. Worksheet layout is prepared in accordance with work procedures   4. Worksheet is built and data manipulated in the worksheet in accordance with workplace procedures   5. Continuous data manipulated on worksheet is undertaken in accordance with work requirements   6. Database design and manipulation is undertaken in accordance with office procedures   7. Data sorting, indexing, storage, retrieval and security is provided in accordance with workplace procedures |
| 1. Apply internet and email in communication at workplace | * 1. Electronic mail addresses are opened and applied in workplace communication in accordance with office policy   2. Office internet functions are defined and executed in accordance with office procedures   3. ***Network configuration*** is determined in accordance with office operations procedures   4. Official World Wide Web is installed and managed according to workplace procedures |
| 1. Apply Desktop publishing in official assignments | * 1. Desktop publishing functions and tools are identified in accordance with manufactures specifications   2. Desktop publishing tools are developed in accordance with work requirements   3. Desktop publishing tools are applied in accordance with workplace requirements   4. Typeset work is enhanced in accordance with workplace standards |
| 1. Prepare presentation packages | * 1. Types of presentation packages are identified in accordance with office requirements   2. Slides are created and formulated in accordance with workplace procedures   3. Slides are edited and run-in accordance with work procedures   4. Slides and handouts are printed according to work requirements |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Appropriate computer hardware may include but not limited to: | Collection of physical parts of a computer system such as:   * Computer case, monitor, keyboard, and mouse * All the parts inside the computer case, such as the hard disk drive, motherboard and video card |
| 1. Data security and privacy may include but not limited to: | * Confidentiality of data * Cloud computing * Integrity -but-curious data surfing |
| 1. Security and control measures may include but not limited to: | * Counter measures against cyber terrorism * Risk reduction * Cyber threat issues * Risk management * Pass-wording |
| 1. Security threats may include but not limited to: | * Cyber terrorism * Hacking |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Analytical skills
* Interpretation
* Typing
* Communication
* Computing (applying fundamental operations such as addition, subtraction, division and multiplication)
* Using calculator
* Basic ICT skills

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Software concept
* Functions of computer software and hardware
* Data security and privacy
* Computer security threats and control measures
* Technology underlying cyber-attacks and networks
* Cyber terrorism
* Computer crimes
* Detection and protection of computer crimes
* Laws governing protection of ICT
* Word processing;
* Functions and concepts of word processing.
* Documents and tables creation and manipulations
* Mail merging
* Word processing utilities
* Spread sheets;
* Meaning, formulae, function and charts, uses and layout
* Data formulation, manipulation and application to cells
* Database;
* Database design, data manipulation, sorting, indexing, storage retrieval and security
* Desktop publishing;
* Designing and developing desktop publishing tools
* Manipulation of desktop publishing tools
* Enhancement of typeset work and printing documents
* Presentation Packages;
* Types of presentation Packages
* Creating, formulating, running, editing, printing and presenting slides and handouts
* Networking and Internet;
* Computer networking and internet.
* Electronic mail and world wide web
* Emerging trends and issues in ICT;
* Identify and integrate emerging trends and issues in ICT
* Challenges posed by emerging trends and issues

**EVIDENCE** **GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Identified and controlled security threats   2. Detected and protected computer crimes   3. Applied word processing in office tasks   4. Designed, prepared work sheet and applied data to the cells in accordance to workplace procedures   5. Opened electronic mail for office communication as per workplace procedure   6. Installed internet and World Wide Web for office tasks in accordance with office procedures   7. Integrated emerging issues in computer ICT applications   8. Applied laws governing protection of ICT |
| 1. Resource Implications | The following resources should be provided:   * 1. Access to relevant workplace where assessment can take place   2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Observation   2. Oral questioning   3. Written test   4. Portfolio of Evidence   5. Interview   6. Third party report |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## DEMONSTRATE ENTREPRENEURIAL SKILLS

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

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT** | **PERFORMANCE CRITERIA** |
| 1. Demonstrate understanding of an Entrepreneur | 1. Entrepreneurs and Business persons are distinguished as per principles of entrepreneurship 2. ***Types of entrepreneurs*** are identified as per principles of entrepreneurship 3. Ways of becoming an Entrepreneur are identified as per principles of Entrepreneurship 4. ***Characteristics of Entrepreneurs*** are identified as per principles of Entrepreneurship 5. Factors affecting Entrepreneurship development are explored as per principles of Entrepreneurship |
| 1. Demonstrate understanding of Entrepreneurship and self-employment | 1. Entrepreneurship and self-employment are distinguished as per principles of entrepreneurship 2. Importance of self-employment is analysed based on business procedures and strategies 3. ***Requirements for entry into self-employment*** are identified according to business procedures and strategies 4. Role of an Entrepreneur in business is determined according to business procedures and strategies 5. Contributions of Entrepreneurs to National development are identified as per business procedures and strategies 6. Entrepreneurship culture in Kenya is explored as per business procedures and strategies 7. Born or made Entrepreneurs are distinguished as per entrepreneurial traits |
| 1. Identify Entrepreneurship opportunities | 1. Sources of business ideas are identified as per business procedures and strategies 2. Business ideas and opportunities are generated as per business procedures and strategies 3. Business life cycle is analysed as per business procedures and strategies 4. Legal aspects of business are identified as per procedures and strategies 5. Product demand is assessed as per market strategies 6. Types of ***business environment*** are identified and evaluated as per business procedures 7. Factors to consider when evaluating business environment are explored based on business procedure and strategies 8. Technology in business is incorporated as per best practice |
| 1. Create entrepreneurial awareness | 1. ***Forms of businesses*** are explored as per business procedures and strategies 2. Sources of business finance are identified as per business procedures and strategies 3. Factors in selecting source of business finance are identified as per business procedures and strategies 4. ***Governing policies*** on Small Scale Enterprises (SSEs) are determined as per business procedures and strategies 5. Problems of starting and operating SSEs are explored as per business procedures and strategies |
| 1. Apply entrepreneurial motivation | 1. ***Internal and external motivation*** factors are determined in accordance with motivational theories 2. Self-assessment is carried out as per entrepreneurial orientation 3. Effective communications are carried out in accordance with communication principles 4. Entrepreneurial motivation is applied as per motivational theories |
| 1. Develop innovative business strategies | 1. Business innovation strategies are determined in accordance with the organization strategies 2. Creativity in business development is demonstrated in accordance with business strategies 3. ***Innovative business strategies*** are developed as per business principles 4. Linkages with other entrepreneurs are created as per best practice 5. ICT is incorporated in business growth and development as per best practice |
| 1. Develop Business Plan | 1. Identified Business is described as per business procedures and strategies 2. Marketing plan is developed as per business plan format 3. Organizational/Management plan is prepared in accordance with business plan format 4. Production/operation plan in accordance with business plan format 5. Financial plan is prepared in accordance with the business plan format 6. Executive summary is prepared in accordance with business plan format 7. Business plan is presented as per best practice |

**RANGE**

This section provides work environment and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Types of entrepreneurs may include but not limited to: | * Innovators * Imitators * Craft * Opportunistic * Speculators |
| 1. Characteristics of Entrepreneurs may include but not limited to: | * Creative * Innovative * Planner * Risk taker * Networker * Confident * Flexible * Persistent * Patient * Independent * Future oriented * Goal oriented |
| 1. Requirements for entry into self-employment may include but not limited to | * Technical skills * Management skills * Entrepreneurial skills * Resources * Infrastructure |
| 1. Internal and external motivation may include but not limited to: | * Interest * Passion * Freedom * Prestige * Rewards * Punishment * Enabling environment * Government policies |
| 1. Business environment may include but not limited to: | * External * Internal * Intermediate |
| 1. Forms of businesses may include but not limited to: | * Sole proprietorship * Partnership * Limited companies * Cooperatives |
| 1. Governing policies may include but not limited to: | * Increasing scope for finance * Promoting cooperation between entrepreneurs and private sector * Reducing regulatory burden on entrepreneurs * Developing IT tools for entrepreneurs |
| 1. Innovative business strategies may include but not limited to: | * New products * New methods of production * New markets * New sources of supplies * Change in industrialization |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Analytical
* Management
* Problem-solving
* Root-cause analysis
* Communication

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Decision making
* Business communication
* Change management
* Competition
* Risk
* Net working
* Time management
* Leadership
* Factors affecting entrepreneurship development
* Principles of Entrepreneurship
* Features and benefits of common operational practices, e. g., continuous improvement (kaizen), waste elimination,
* Conflict resolution
* Health, safety and environment (HSE) principles and requirements
* Customer care strategies
* Basic financial management
* Business strategic planning
* Impact of change on individuals, groups and industries
* Government and regulatory processes
* Local and international market trends
* Product promotion strategies
* Market and feasibility studies
* Government and regulatory processes
* Local and international business environment
* Relevant developments in other industries
* Regional/ County business expansion strategies

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | 1. Assessment requires evidence that the candidate: 2. Distinguished entrepreneurs and businesspersons correctly 3. Identified ways of becoming an entrepreneur appropriately 4. Explored factors affecting entrepreneurship development appropriately 5. Analysed importance of self-employment accurately 6. Identified requirements for entry into self-employment correctly 7. Identified sources of business ideas correctly 8. GeneratedBusiness ideas and opportunities correctly 9. Analysed business life cycle accurately 10. Identified legal aspects of business correctly 11. Assessed product demand accurately 12. Determined Internal and external motivation factors appropriately 13. Carried out communications effectively 14. Identified sources of business finance correctly 15. Determined Governing policy on small scale enterprise appropriately 16. Explored problems of starting and operating SSEs effectively 17. Developed Marketing, Organizational/Management, Production/Operation and Financial plans correctly 18. Prepared executive summary correctly 19. Determined business innovative strategies appropriately 20. Presented business plan effectively |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | 1. Written tests 2. Oral questions 3. Third party report 4. Interviews 5. Portfolio of Evidence |
| 1. Context of Assessment | Competency may be assessed   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# 

## DEMONSTRATE EMPLOYABILITY SKILLS

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

**UNIT DESCRIPTON**

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.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Conduct self-management | 1. Personal vision, mission and goals are formulated based on potential and in relation to organization objectives 2. Emotional intelligence is demonstrated as per workplace requirements. 3. Individual performance is evaluated and monitored according to the agreed targets. 4. Assertiveness is developed and maintained based on the requirements of the job. 5. Accountability and responsibility for own actions are demonstrated based on workplace instructions. 6. Self-esteem and a positive self-image are developed and maintained based on values. 7. Time management, attendance and punctuality are observed as per the organization policy. 8. Goals are managed as per the organization’s objective 9. Self-strengths and weaknesses are identified based on personal objectives |
| 1. Demonstrate interpersonal communication | 1. Writing skills are demonstrated as per communication policy 2. Negotiation and persuasion skills are demonstrated as per communication policy 3. Internal and external stakeholders’ needs are identified and interpreted as per the communication policy 4. Communication networks are established based on workplace policy 5. Information is shared as per communication policy |
| 1. Demonstrate critical safe work habits | * 1. Stress is managed in accordance with workplace policy.   2. Punctuality and time consciousness is demonstrated in line with workplace policy.   3. Personal objectives are integrated with organization goals based on organization’s strategic plan.   4. ***Resources*** are utilized in accordance with workplace policy.   5. Work priorities are set in accordance to workplace goals and objectives.   6. Leisure time is recognized and utilized in line with personal objectives.   7. ***Drugs and substances of abuse*** are identified and avoided based on workplace policy.   8. HIV and AIDS prevention awareness is demonstrated in line with workplace policy.   9. Safety consciousness is demonstrated in the workplace based on organization safety policy.   10. ***Emerging issues*** are identified and dealt with in accordance with organization policy. |
| 1. Lead a workplace team | 1. Performance targets for the ***team*** are set based on organization’s objectives 2. Duties are assigned in accordance with the organization policy. 3. ***Forms of communication*** in a team are established according to organization’s policy. 4. Team performance is evaluated based on set targets as per workplace policy. 5. Conflicts are resolved between team members in line with organization policy. 6. Gender related issues are identified and mainstreamed in accordance workplace policy. 7. Human rights and fundamental freedoms are identified and respected as Constitution of Kenya 2010. 8. Healthy relationships are developed and maintained in line with workplace. |
| 1. Plan and organize work | 1. Work plans are prepared based on activities and budget. 2. Assigned tasks are interpreted and expectations identified as per the workplace instructions. 3. Task occupational safety and health requirements are identified and observed regulations. 4. Work resources are identified, mobilized, allocated and utilized based on organization work plans. 5. Work activities are monitored and evaluated in line with work plans and workplace policy. 6. Work plans are reviewed based on target and available resources. |
| 1. Maintain professional growth and development | * 1. Personal training needs are identified and assessed in line with the requirements of the job.   2. ***Training and career opportunities*** are identified and utilized based on job requirements.   3. Resources for training are mobilized and allocated based organizations and individual skills needs.   4. Licensees and certifications relevant to job and career are obtained and renewed as per policy.   5. Work priorities and personal commitments are balanced and managed based on requirements of the job and personal objectives.   6. Recognitions are sought as proof of career advancement in line with professional requirements. |
| 1. Demonstrate workplace learning | * 1. Learning opportunities are sought and managed based on job requirement and organization policy.   2. Improvement in performance is demonstrated based on courses attended.   3. Application of learning is demonstrated in both technical and non-technical aspects based on requirements of the job   4. Time and effort is invested in learning new skills based on job requirements   5. Initiative is taken to create more effective and efficient processes and procedures in line with workplace policy.   6. New systems are developed and maintained in accordance with the requirements of the job.   7. Awareness of personal role in workplace ***innovation*** is demonstrated based on requirements of the job. |
| 1. Demonstrate problem solving skills | * 1. Creative, innovative and practical solutions are developed based on the problem   2. Independence and initiative in identifying and solving problems is demonstrated based on requirements of the job.   3. Team problems are solved as per the workplace guidelines   4. Problem solving strategies are applied as per the workplace guidelines   5. Problems are analyzed and assumptions tested as per the context of data and circumstances |
| 1. Manage ethical performance | * 1. Policies and guidelines are observed as per the workplace requirements   2. Self-worth and professionalism is exercised in line with personal goals and organizational policies   3. Code of conduct is observed as per the workplace requirements   4. Integrity is demonstrated as per legal requirement |

**RANGE**

This section provides work environment and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Drug and substance abuse may include but not limited to: | Commonly abused   * Alcohol * Tobacco * Miraa * Over-the-counter drugs * Cocaine * Bhang * Glue |
| 1. Feedback may includee but not limited to: | * Verbal * Written * Informal * Formal |
| 1. Relationships may include but not limited to: | * Man/Woman * Trainer/trainee * Employee/employer * Client/service provider * Husband/wife * Boy/girl * Parent/child * Sibling relationships |
| 1. Forms of communication may include but not limited to: | * Written * Visual * Verbal * Non verbal * Formal and informal |
| 1. Team may include but not limited to: | * Small work group * Staff in a section/department * Inter-agency group |
| 1. Personal growth may include but not limited to: | * Growth in the job * Career mobility * Gains and exposure the job gives * Net workings * Benefits that accrue to the individual as a result of noteworthy performance |
| 1. Personal objectives may include but not limited to: | * Long term * Short term * Broad * Specific |
| 1. Trainings and career opportunities may include but not limited to | * Participation in training programs * Serving as Resource Persons in conferences and workshops |
| 1. Resource may include may but not limited to: | * Human * Financial * Technology |
| 1. Innovation may include but not limited to: | * New ideas * Original ideas * Different ideas * Methods/procedures * Processes * New tools |
| 1. Emerging issues may include but not limited to: | * Terrorism * Social media * National cohesion * Open offices |
| 1. Range of media for learning may include but not limited to: | * Mentoring * peer support and networking * IT and courses |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Interpersonal
* Communication
* Critical thinking
* Organizational
* Negotiation
* Monitoring
* Evaluation
* Record keeping
* Problem solving
* Decision Making
* Resource utilization
* Resource mobilization

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Work values and ethics
* Company policies
* Company operations, procedures and standards
* Occupational Health and safety procedures
* Fundamental rights at work
* Workplace communication
* Concept of time
* Time management
* Decision making
* Types of resources
* Work planning
* Organizing work
* Monitoring and evaluation
* Record keeping
* Gender mainstreaming
* HIV and AIDS
* Drug and substance abuse
* Professional growth and development
* Technology in the workplace
* Innovation
* Emerging issues

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   * 1. Conducted self-management   2. Demonstrated interpersonal communication   3. Demonstrated critical safe work habits   4. Demonstrated the ability to lead a workplace team   5. Planned and organized work   6. Maintained professional growth and development   7. Demonstrated workplace learning   8. Demonstrated problem solving skills   9. Demonstrated the ability to manage performance ethically |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Observation 2. Oral questioning 3. Written test 4. Portfolio of Evidence 5. Interview 6. Third party report |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## DEMONSTRATE ENVIRONMENTAL LITERACY

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

**UNIT DESCRIPTION**

This unit specifies the competencies required to demonstrate environmental literacy. It involves, controlling environmental hazard and environmental pollution, demonstrating 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, analyzing resource use and developing resource conservation plans

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Control environmental hazard | 1. Storage methods for environmentally hazardous materials are strictly followed according to environmental regulations and OSHS. 2. Disposal methods of hazardous wastes are followed according to environmental regulations and OSHS. 3. ***PPE*** is used according to OSHS. |
| 1. Control environmental Pollution | * 1. Environmental pollution ***control measures*** are implemented in accordance with international protocols.   2. Procedures for solid waste management are observed according Environmental Management and Coordination Act 1999   3. Methods for minimizing noise pollution is complied with based on Noise and Excessive Vibration Pollution and Control Regulations, 2009 |
| 1. Demonstrate sustainable resource use | * 1. Methods for minimizing wastage are complied with based on organizational waste management guide   2. Waste management procedures are employed following principles of 3Rs (Reduce, Reuse, Recycle)   3. Methods for economizing and reducing resource consumption are practiced as per the Constitution of Kenya 2010 Article 69 . |
| 1. Evaluate current practices in relation to resource usage | * 1. Information on resource efficiency systems and procedures are collected and provided as per work groups/sector   2. Current resource usage is measured and recorded as per work group   3. Current purchasing strategies are analyzed and recorded according to industry procedures.   4. Current work processes to access information and data is analyzed following enterprise protocol. |
| 1. Identify environmental legislations/conventions for environmental concerns | 1. Environmental legislations/conventions and local ordinances are identified according to the different environmental aspects/impact 2. Industrial standard/environmental practices are described according to the different environmental concerns |
| 1. Implement specific environmental programs | 1. Programs/Activities are identified according to organizations policies and guidelines. 2. Individual roles/responsibilities are determined and performed based on the activities identified. 3. Problems/constraints encountered are resolved in accordance with organizations’ policies and guidelines 4. Stakeholders are consulted based on company guidelines |
| 1. Monitor activities on Environmental protection/Programs | 1. Activities are periodically monitored and Evaluated according to the objectives of the environmental program 2. Feedback from stakeholders are gathered and considered in Proposing enhancements to the program based on consultations 3. Data gathered are analyzed based on Evaluation requirements 4. Recommendations are submitted based on the findings 5. Management support systems are set/established to sustain and enhance the program 6. Environmental incidents are monitored and reported to 7. concerned/proper authorities |
| 1. Analyze resource use | 1. All resource consuming processes are Identified as per the organizational work plan 2. Quantity and nature of resource consumed is determined based on processes 3. Resource flow is analyzed as per different parts of the process. 4. Wastes are classified according to NEMA regulations on waste management. |
| 1. Develop resource Conservation plans | 9.1. Efficiency of use/conversion of resources is determined according to industry protocol.  9.2. Causes of low efficiency of use of resources are Determined based on industry protocol.  9.3. Plans for increasing the efficiency of resource use are developed based on findings. |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. PPE may include but not limited to | * + Mask   + Gloves   + Goggles   + Safety hat   + Overall * Hearing protector |
| 1. Control measures may include but not limited to | * Methods for minimizing or stopping spread and ingestion of airborne particles * Methods for minimizing or stopping spread and ingestion of gases and fumes * Methods for minimizing or stopping spread and ingestion of liquid wastes |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Measuring
* Recording
* Analytical
* Monitoring
* Communication
* Writing

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* PPEs
* Environmental regulations
* OSHS
* Pollution
* Waste management
* Principle of 3Rs
* Types of resources
* Techniques in measuring current usage of resources
* Environmental hazards
* Regulatory requirements

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Controlled environmental hazard   2. Controlled environmental pollution   3. Demonstrated sustainable resource use   4. Evaluated current practices in relation to resource usage   5. Demonstrated knowledge of environmental legislations and local ordinances according to the different environmental issues /concerns.   6. Described industrial standard environmental practices according to the different environmental issues/concerns.   7. Resolved problems/ constraints encountered based on management standard procedures   8. Implemented and monitored environmental practices on a periodic basis as per company guidelines   9. Recommended solutions for the improvement of the program   10. Monitored and reported to proper authorities any environmental incidents |
| 1. Resource Implications | The following resources should be provided:   * 1. Workplace with storage facilities   2. Tools, materials and equipment relevant to the tasks (e.g. Cleaning tools, cleaning materials, trash bags)   3. PPE, manuals and references   4. Legislation, policies, procedures, protocols and local ordinances relating to environmental protection   5. Case studies/scenarios relating to environmental Protection |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Observation   2. Oral questioning   3. Written test   4. Portfolio of Evidence   5. Interview   6. Third party report |
| 1. Context of Assessment | Competency may be assessed   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## DEMONSTRATE OCCUPATIONAL SAFETY AND HEALTH PRACTICES

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

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Identify workplace hazards and risk | 1.1 ***Hazards*** in the workplace are identified ***based their indicators***  1.2 Risks and hazards are evaluated based on legal requirements.  1.3 ***OSH concerns*** raised by workers are addressed as per legal requirements. |
| 1. Control OSH hazards | 2.1 Hazard prevention ***and control measures*** are implemented as per legal requirement.  2.2 Risk assessment is conductedand a risk matrix developed based on likely impact.  2.3 ***Contingency measures***, including ***emergency procedures*** during workplace ***incidents and emergencies*** are recognized and established in accordance with organization procedures. |
| 1. Implement OSH programs | 3.1 Company OSH program are identified, evaluated and reviewed based on legal requirements.  3.2 Company OSH programs are implemented as per legal requirements.  3.3 Workers are capacity built on OSH standards and procedures as per legal requirements  3.4 ***OSH-related records*** are maintained as per legal requirements. |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Hazards may include but not limited to: | * Physical hazards – impact, illumination, pressure, noise, * vibration, extreme temperature, radiation * Biological hazards- bacteria, viruses, plants, parasites, mites, molds, fungi, insects * Chemical hazards – dusts, fibers, mists, fumes, smoke, gasses, vapors * Ergonomics * Psychological factors – over exertion/ excessive force,   awkward/static positions, fatigue, direct pressure,   * varying metabolic cycles * Physiological factors – monotony, personal relationship, work out cycle * Safety hazards (unsafe workplace condition) –confined space, excavations, falling objects, gas leaks, electrical, poor storage of materials and waste, spillage, waste and debris * Unsafe workers’ act (Smoking in off-limited areas, Substance and alcohol abuse at work) |
| 1. Indicators may include but not limited to: | * Increased of incidents of accidents, injuries * Increased occurrence of sickness or health complaints/ symptoms * Common complaints of workers related to OSH * High absenteeism for work-related reasons |
| 1. OSH concerns may include but not limited to: | * Workers’ experience/observance on presence of work hazards * Unsafe/unhealthy administrative arrangements (prolonged work hours, no break time, constant overtime, scheduling of tasks) * Reasons for compliance/non-compliance to use of PPEs or other OSH procedures/policies/guidelines |
| 1. Safety gears /PPE (Personal Protective Equipment) may include but not limited to: | * 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 |
| 1. Appropriate risk controls   may include but not limited to: | * Appropriate risk controls in order of impact are as follows: * Eliminate the hazard altogether (i.e., get rid of the dangerous machine) * Isolate the hazard from anyone who could be harmed (i.e., keep the machine in a closed room and operate it remotely; barricade an unsafe area off) * Substitute the hazard with a safer alternative (i.e., replace the machine with a safer one) * Use administrative controls to reduce the risk (i.e., train workers how to use equipment safely; train workers about the risks of harassment; issue signage) * Use engineering controls to reduce the risk (i.e., attach guards to the machine to protect users) * Use personal protective equipment (i.e., wear * gloves and goggles when using the machine) |
| 1. Contingency measures may include but not limited to: | * Evacuation * Isolation * Decontamination * (Calling designed) emergency personnel |
| 1. Incidents and emergencies may include but not limited to: | * Chemical spills * Equipment/vehicle accidents * Explosion * Fire * Gas leak * Injury to personnel * Structural collapse * Toxic and/or flammable vapors emission. |
| 1. OSH-related Records may include but not limited to: | * Medical/Health records * Incident/accident reports * Sickness notifications/sick leave application * OSH-related trainings obtained |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Communication
* Interpersonal
* Presentation
* Risk assessment
* Evaluation
* Critical thinking
* Problem solving
* Negotiation

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* General OSH Principles
* Occupational hazards/risks recognition
* OSH organizations providing services on OSH evaluation and/or work environment measurements (WEM)
* National OSH regulations; company OSH policies and protocols
* Systematic gathering of OSH issues and concerns
* General OSH principles
* National OSH regulations
* Company OSH and recording protocols, procedures and policies/guidelines
* Training and/or counseling methodologies and strategies

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   1. Identified hazards in the workplace based their indicators 2. Evaluated workplace hazards based on legal requirements. 3. Addressed OSH concerns raised by workers as per legal requirements. 4. Implemented hazard prevention and control measures as per legal requirement. 5. Conducted risk assessment as per legal requirement. 6. Developed risk matrix based on likely impact. 7. Recognized and established contingency measures in accordance with organization procedures. 8. Identified, evaluated and reviewed company OSH program based on legal requirements. 9. Implemented company OSH programs as per legal requirements. 10. Capacity built workers on OSH standards and procedures as per legal requirements 11. Maintained OSH-related records as per legal requirements. |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Observation 2. Oral questioning 3. Written test 4. Portfolio of Evidence 5. Interview 6. Third party report |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# COMMON UNITS OF COMPETENCY

## PREPARE AND INTERPRET TECHNICAL DRAWINGS

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

**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

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Use drawing equipment and materials | * 1. ***Drawing equipment*** are obtained according to task requirements   2. ***Drawing materials*** are obtained according to task requirements   3. Drawing equipment are used according to manufacturer instructions   4. Drawing materials are used according to task requirements   5. Waste materials are disposed in accordance with workplace procedures and ***environmental legislations***   6. ***Relevant Personal Protective Equipment*** is used according to occupational safety and health regulations |
| 1. Produce plain geometry drawings | * 1. Lettering and line work is done according to drawing rules   2. Sketches of ***geometric forms*** are interpreted according to standard conventions   3. Different types of angles are constructed according to principles of trigonometry   4. Different types of geometric forms are constructed according to standard drawing conventions   5. Constructed geometric forms are dimensioned according to drawing requirements |
| 1. Produce pictorial and orthographic drawings of components | * 1. Different symbols and abbreviations are identified and their meaning interpreted according to standard drawing conventions   2. Isometric sketches and drawings of components are interpreted and produced in accordance with the standard conventions of isometric drawings   3. First and third angle orthographic sketches and drawings of components are produced in accordance with the standard conventions of orthographic drawings   4. Freehand sketching of different types of geometric forms is conducted based on task requirements |
| 1. Produce assembly drawings | * 1. Orthographic views are exploded according to standard conventions of orthographic drawings.   2. Pictorial views are exploded according to standard conventions of orthographic drawings.   3. Part lists are identified according to drawing specifications   4. Sectional views are produced according to standard conventions of drawing.   5. Produced drawing is hatched according to standard conventions of drawings. |
| 1. Apply basic CAD in technical drawing | * 1. ***CAD software*** are identified according to work requirements   2. 2-D models are produced according to work requirements   3. 3D models are produced according to work requirements   4. Produced models are annotated according to work requirements |

**RANGE**

| **Variable** | **Range** |
| --- | --- |
| 1. Drawing equipment may include but is not limited to: | * Drawing boards * T-square * Set squares * Drawing set * French curves * Computers |
| 1. Drawing materials may include but is not limited to: | * Drawing papers * Pencils * Erasers * Masking tapes * Paper clips |
| 1. CAD software may include but is not limited to: | * AutoCAD * Inventor * Solid Works * Archi CAD * Electronic work bench * Circuit maker * Proteus |
| 1. Sketches of patterns may include but is not limited to: | * Cylinders * Prisms * Pyramids |
| 1. Interpenetrations of solids may include but is not limited to: | * Cylinder to cylinder * Cylinder to prism * Prism to prism |
| 1. Environmental legislations may include but is not limited to: | * EMCA 1999 * NEMA Regulations |
| 1. Personal Protective Equipment may include but is not limited to: | * Dust coats * Closed leather shoes |
| 1. Geometric forms may include but is not limited to: | * Circles * Triangles * Rectangles * Parallelogram * Polygons * Pyramids * Conic sections * Prisms * Loci |
| 1. Standard drawing conventions may include but is not limited to: | * Anatomy of engineering drawing (title block, coordinate grid system, revision block, notes and legends) * Drawing scale (paper size and drawing symbols) * International drawing standards |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required skills**

The individual needs to demonstrate the following skills:

* Drawing
* Freehand sketching
* Ability to use software
* Critical thinking
* Interpretation
* Drawing equipment handling
* Analysis and synthesis
* Communication
* Inter personal relations

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Drawing equipment and materials
* Freehand sketching
* Lettering
* Geometrical constructions
* Types of drawings
* Types of lines
* Engineering calculations
* Isometric drawing conventions, features, characteristics, components
* Orthographic drawing conventions, features, characteristics, components
* Sketches and drawings of simple patterns

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required knowledge and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Applied and adhered to safety procedures   2. Used and cared for drawing equipment   3. Interpreted circuit, assembly and lay out diagrams   4. Applied appropriate technical standards   5. Used proper tools and equipment for a given task   6. Produced sketches and drawings   7. Applied basic CAD in production of drawings |
| 1. Resource Implications | The following resources should be provided:   * 1. Drawing equipment and materials   2. Computers   3. CAD software   4. Relevant PPE   5. Internet   6. Equipped drawing room |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Practical tests   2. Observation   3. Written tests |
| 1. Context of Assessment | Competency may be assessed individually in the actual workplace or a simulated work place setting or during industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY MATHEMATICS PRINCIPLES

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

**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.

This standard applies in the extractives sector.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  *Bold and italicized terms are elaborated in the Range.* |
| --- | --- |
| * 1. Apply Algebra | * 1. Calculations involving Indices are performed as per the concept   2. Calculations involving Logarithms are performed as per the concept   3. Scientific calculator is used in solving mathematical problems in line with manufacturer’s manual   4. Simultaneous equations are performed as per the rules   5. Quadratic equations are calculated as per the concept |
| * 1. Apply Trigonometry and hyperbolic functions | * 1. Calculations are performed using trigonometric rules   2. Calculations are performed using hyperbolic functions |
| * 1. Apply complex numbers | * 1. Complex numbers are represented using Argand diagrams   2. Operations involving complex numbers are performed   3. Calculations involving complex numbers are performed using De Moivre’s theorem |
| * 1. Apply Coordinate Geometry | * 1. Polar equations are calculated using coordinate geometry   2. Graphs of given polar equations are drawn using the Cartesian plane   3. Normals and tangents are determined using coordinate geometry |
| * 1. Carry out Binomial Expansion | * 1. Roots of numbers are determined using binomial theorem   2. Errors and small changes are determined using binomial theorem |
| * 1. Apply Calculus | * 1. Derivatives of functions are determined using Differentiation   2. Derivatives of hyperbolic functions are determined using Differentiation   3. Derivatives of inverse trigonometric functions are determined using Differentiation   4. Rate of change and small change are determined using Differentiation.   5. Calculation involving stationery points of functions of two variables are performed using differentiation.   6. Integrals of algebraic functions are determined using integration   7. Integrals of trigonometric functions are determined using integration   8. Integrals of logarithmic functions are determined using integration   9. Integrals of hyperbolic and inverse functions are determined using integration |
| * 1. Solve Ordinary differential equations | * 1. First order and second order differential equations are solved using the method of undetermined coefficients   7.2 First order and second order differential equations are solved from given boundary conditions |
| * 1. Carry out Mensuration | * 1. Perimeter and areas of figures are obtained   2. Volume and Surface area of solids are obtained   3. Area of irregular figures are obtained   4. Areas and volumes are obtained using Pappus theorem |
| * 1. Apply Power Series | * 1. Power series are obtained using Taylor’s Theorem   2. Power series are obtained using McLaurin’s ‘s theorem |
| * 1. Apply Statistics | * 1. Mean, median ,mode and Standard deviation are obtained from given data   2. Calculations are performed based on Laws of probability   3. Calculation involving *probability distributions* , mathematical expectation sampling distributions are performed   4. Sampling distribution methods are applied in data analysis   5. Calculations involving use of standard normal table, sampling distribution, T-distribution and Estimation are done   6. Confidence intervals are determined |
| * 1. Apply Numerical methods | * 1. Roots of polynomials are obtained using iterative *numerical methods*   2. Interpolation and extrapolation are performed using numerical methods |
| * 1. Apply Vector theory | * 1. Vectors and scalar quantities are obtained in two and three dimensions   2. *Operations* on vectors are performed   3. Position of vectors is obtained   4. Resolution of vectors is done |
| * 1. Apply Matrix | * 1. Determinant and inverse of 3x3 matrix are obtained   2. Solutions of simultaneous equations are obtained   3. Calculation involving Eigen values and Eigen vectors are performed |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Operations may include but not limited to: | * Addition * Subtraction |
| 1. Hyperbolic functions may include but not limited to: | * Sinh x * Cosh x * Cosec x * Coth x * Tanh x * Sech x |
| 1. Probability Distributions may include but not limited to: | * Binomial * Poisson * Normal |
| 1. Numerical Methods may include but not limited to: | * Newton Raphson * Gregory Newton |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Analytical
* Communication
* Logical thinking
* Problem solving
* Drawing
* Sketching
* Interpersonal
* Organization

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Mensuration
* Vector operations
* Matrix operations
* Calculus
* Statistics
* Ordinary differential equations
* Power series
* Complex numbers
* Algebra
* Trigonometry and hyperbolic functions
* Coordinate Geometry
* Binomial Expansion
* Numerical methods

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   1. Applied algebra correctly. 2. Applied Trigonometry and hyperbolic functions correctly. 3. Applied complex numbers correctly. 4. Applied Calculus correctly. 5. Solved Ordinary differential equations correctly. 6. Carried out mensuration correctly. 7. Applied Power Series correctly. 8. Applied Vector theory correctly. 9. Applied Matrix correctly. 10. Applied Numerical methods correctly. 11. Applied statistics correctly. 12. Applied binomial expansion correctly. 13. Applied co-ordinate geometry correctly. |
| 1. Resource Implications | The following resources should be provided:   * 1. Access to relevant workplace or appropriately simulated environment where assessment can take place   2. Measuring equipment   3. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Written tests 2. Observation 3. Oral Questioning 4. Interview |
| 1. Context of Assessment | Competency may be assessed:   1. On-the –job 2. Off-the-job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY CHEMISTRY PRINCIPLES

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

**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.

This standard applies in the extractives sector

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | | **PERFORMANCE CRITERIA**  ***(Bold and italicised terms are elaborated in the Range)*** | |
| --- | --- | --- | --- |
| 1. Apply inorganic chemistry | | 1.1 ***Elements*** and their properties are reviewed based on their structure.  1.2 The particulate nature of matter is explored based on kinetic theory.  1.3 ***Isotopes*** are explored based on their stability and their radiogenic properties.  1.4 Atoms are explored in terms structure and bonding.  1.5 The periodic table is explored as per groups and periods.  1.6 ***Transition elements*** are explored based on their physical properties and uses.  1.7 ***Minerals and Ores*** are explored in terms of their importance and extraction techniques.  1.8 Nuclear chemistry is explored in terms of energy of the nuclear, radioactivity and their applications. | |
| 1. Apply organic chemistry | | 1. ***Organic compounds*** are identified and studied based on general properties and sources. 2. Organic compounds are classified and named based on composition and structure. 3. Organic compounds are identified and studied based on their biological importance and formation processes. 4. Distribution of organic compounds is studied based on their occurrence in water and soils. 5. ***Geochemical properties*** of organic compounds are studied based on their complexing and adsorbent behavior. 6. ***Organic minerals*** are studied based on formation and composition. 7. Effects of organic compounds are studied based on of carbon cycle. | |
| 1. Apply physical chemistry | | * 1. Phase equilibrium of elements is explored in terms of physical, chemical and homogeneity properties.   2. ***Acids and bases*** are explored based on their definition, reactions, classification and their properties.   3. Reduction and Oxidation reactions are explored in terms of their potentials and conditions.   4. Aqueous chemistry is explored in terms of equilibrium and chemical reactivity. | |
| 1. Apply analytical chemistry | | * 1. Chemical separation is explored in terms of ***separation techniques***, composition and purpose of separation.   2. ***Chemical analytical techniques*** are used to analyse bulk sample composition based on the purpose. | |

**RANGE**

| **Variable** | **Range** |
| --- | --- |
| 1. Organic compounds may include but is not limited to: | * Hydrocarbons * Alkyl halides * Aromatic compounds * Hydroxyl compounds/ alcohol * Carbonyl compounds * Carboxylic acids * Esters * Organo-nitrogen compounds * Polymers |
| 1. Geochemical properties may include but is not limited to: | * Acid-base properties * Adsorption * Absorption * Separation |
| 1. Organic minerals may include but is not limited to: | * Coal * Oil * Hydrocarbon gas |
| 1. Elements include but not limited to: | * Hydrogen * Oxygen * Sodium * Nitrogen * Methane |
| 1. Isotopes include but not limited to: | * Oxygen- 16, 17, 18 * Carbon -12, 13,14 * Uranim- 235,238 * Hydrogen – 1, 2, 3 |
| 1. Transition elements include but not limited to: | * Iron * Copper * Chromium * Manganese * Vanadium * Titanium * Nickel |
| 1. Minerals may include but not limited to: | * Quartz (Silica) * Calcite * Phlogopite * Sillimanite * Andalusite * Magnetite * Apatite |
| 1. Ores may include but not limited to: | * magnetite * corundum * Magnesium * galena * malachite |
| 1. Acids and bases include but not limited to: | * Acids: * Organic * Inorganic * Bases: * Soluble * insoluble |
| 1. Chemical separation techniques may include but limited to: | * Chromatography * Froth flotation * Metal leaching * Fractional distillation * Electrophoresis * Electrolysis * Electro-chromatography |
| 1. Chemical analytical techniques may include but limited to: | * Atomic Absorption Spectrometry (AAS) * X-ray florescence (XRF) * Infra-red spectroscopy (IR) * X-ray diffraction (XRD) * Calorimetry * Carbon analyser |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required skills**

The individual needs to demonstrate the following skills:

* Report writing
* Lab practice
* Communication
* Interpersonal
* Critical thinking
* Problem solving
* Logical thinking
* Organizational

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Elements and their properties
* The particulate nature of matter
* Isotopes
* Atoms
* The periodic table
* Transition elements
* Minerals and Ores
* Nuclear chemistry
* Organic compounds
* Distribution of organic compounds
* Geochemical properties of organic compounds
* Organic minerals
* Phase equilibrium of elements
* Acids and bases
* Reduction and Oxidation reactions
* Aqueous chemistry
* Chemical separation
* Chemical analytical techniques

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required knowledge and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:  1.1 Demonstrated understanding of:   * The periodic table * Elements and their properties * The particulate nature of matter * Isotopes * Atoms * Crystal system * The periodic table * Transition elements * Minerals and Ores * Nuclear chemistry * Organic compounds * Distribution of organic compounds * Geochemical properties of organic compounds * Organic minerals * Phase equilibrium of elements * Acids and bases * Reduction and Oxidation reactions * Aqueous chemistry * Chemical separation * Chemical analytical techniques   1.2 Demonstrated ability to:   * Prepare solutions * Standardize solutions * Electroplate materials * Prepare crystals * Separate chemicals * Identify organic compounds and minerals * Prepare Organic compounds * Liquefy gases * Perform fractional distillation * Perform titration * Analyze chemical reactions * Identify ionic and covalent bond |
| 1. Resource Implications | The following resources should be provided:   * 1. Access to relevant workplace or appropriately simulated environment where assessment can take place   2.2 Laboratory  2.3 Relevant reagents  2.4 Relevant apparatus  2.5 Relevant chemicals |
| 1. Methods of Assessment | Competency may be assessed through:   1. Observation 2. Written tests 3. Practical’s |
| 1. Context of Assessment | Competency may be assessed:   1. On-the- job 2. Off-the-job 3. Workplace experience 4. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY PHYSICS PRINCIPLES

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

**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.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range.*** |
| --- | --- |
| 1. Apply the concept of basic quantities of measurement | * 1. ***Phases of matter*** are explored as per kinetic theory.   2. ***Dimensions of space*** are explored as per coordinate system.   3. Concept of time is explored in relation to matter and space.   4. Nature and ***properties of matter*** are explored in relation to applied stress.   5. ***Parameters of measurement*** are measured, recorded and interpreted. |
| 1. Apply principles of mechanics | * 1. ***Forces*** are explored based on principles of vectors   2. Statics and Kinematics are explored based on laws of motion.   3. Velocity ratio, mechanical advantage and efficiency of machines are determined based on type of machine.   4. Acoustics and waves are explored based on propagation modes. |
| 1. Apply principles of thermodynamics | * 1. ***Temperature scales*** are explored based on physical properties.   2. ***Modes of heat transfer*** are explored based on mechanism.   3. Thermodynamic work is explored as per laws of thermodynamics. |
| 1. Apply principles of optics | * 1. Production and nature of light is explored based on principles of quantum optics.   2. Light as a particle is explored according to laws of geometric optics.   3. ***Wave aspects of light*** are explored according to laws of physical optics.   4. Absorption, transmission and polarization of light are explored based on relevant laws. |
| 1. Apply principles of electromagnetic theory | * 1. Principles of electrostatics are explored based on Coulomb’s laws.   2. Principles of magnetism are explored based on the behaviour of magnetic fields   3. Electromagnetism is explored based on electromagnetic induction laws.   4. Modification of electromagnetic induction laws is explored based on Maxwell’s theory.   5. Electromagnetic waves are explored based on production and propagation. |
| 1. Apply principles of current electricity | 1. ***Sources of electromotive force*** (emf) are explored based on energy conversion mechanisms. 2. Concept of basic electric circuits and electrical quantities are explored based on principles of charge flow. 3. Direct Current (D.C.) transients are explored based on Ohm’s law and Kirchhoff’s rules. 4. Principles of Alternating Current (A.C) circuits are explored based on electrical reactance theories. 5. ***Basic electrical appliances*** are explored based on construction and purpose. |
| 1. Apply principles of basic electronics | * 1. Semiconducting materials are explored based on the band theory.   2. Types of conduction are explored based on doping principles.   3. Assembling of electronic gadgets is explored based on biasing principles. |
| 1. Apply principles of modern physics | * 1. Principles of relativity are explored based on Galilean, Einstein’s and Lorentz’s theories.   2. Principles of atomic and nuclear physics are explored as per Bohr’s and radioactivity theorems.   3. Principles of wave mechanics are explored based on de Broglie and Schrödinger postulates.   4. Principles of Particle physics are explored based on energy- matter conversion. |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Phases of matter may include but is not limited to: | * + Solids   + Liquids   + Gases/vapor |
| 1. Dimensions of space may include but is not limited to: | * + linear   + laminar   + bulk |
| 1. Properties of matter may include but not limited to: | * + Density   + Pressure   + Surface tension   + Strength of materials |
| 1. Forces may include but is not limited to: | * + Statics   + Dynamics |
| 1. Temperature scales may include but is not limited to: | * + Celsius   + Fahrenheit   + Kelvin |
| 1. Modes of heat transfer are may include but is not limited to: | * + Radiation   + Convection   + conduction |
| 1. Wave aspects of light may include but is not limited to: | * + Refraction   + Reflection   + diffraction   + superposition   + interference |
| 1. Basic electrical appliances may include but not limited to: | * + Lighting   + Heating   + Motor effect |
| 1. Sources of electromotive force may include but not limited to: | * + Cell   + Generators   + Magnetic field |
| 1. Parameters of measurement may include but not limited to: | * + Temperature   + Mass   + Length   + Time |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Use basic equipment and tools
* Lab practice
* Communication
* Interpersonal skills
* Interpretation
* Analytical
* Logical thinking
* Critical thinking
* Problem solving

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Laws, theorems and postulates of physics
* Phases of matter
* Dimensions of space
* Concept of time
* Nature and properties of matter
* Parameters of measurement
* Forces
* Statics and Kinematics
* Velocity ratio, mechanical advantage and efficiency of machines
* Acoustics and waves
* Temperature scales
* Modes of heat transfer
* Thermodynamic work
* Production and nature of light
* Light as a particle
* Wave aspects of light
* Absorption, transmission and polarization
* Principles of electrostatics
* Principles of magnetism
* Electromagnetism
* Modification of electromagnetic induction laws
* Electromagnetic waves
* Sources of electromotive force
* Concept of basic electric circuits and electrical quantities
* Direct Current (D.C.) transients
* Principles of Alternating Current (A.C) circuits
* Basic electrical appliances
* Semiconducting materials
* Types of conductivity
* Construction of electronic gadgets
* Principles of relativity
* Principles of atomic and nuclear physics
* Principles of wave mechanics
* Principles of Particle physics

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:  1.1 Demonstrated understanding of:   * Laws, theorems and postulates of physics * Phases of matter * Dimensions of space * Concept of time * Nature and properties of matter * Parameters of measurement * Forces * Statics and Kinematics * Velocity ratio, mechanical advantage and efficiency of machines * Acoustics and waves * Temperature scales * Modes of heat transfer * Thermodynamic work * Production and nature of light * Light as a particle * Wave aspects of light * Absorption, transmission and polarization * Principles of electrostatics * Principles of magnetism * Electromagnetism * Modification of electromagnetic induction laws * Electromagnetic waves * Sources of electromotive force * Concept of basic electric circuits and electrical quantities * Direct Current (D.C.) transients * Principles of Alternating Current (A.C) circuits * Basic electrical appliances * Semiconducting materials * Types of semiconductor conduction * Assembling of electronic gadgets * Principles of relativity * Principles of atomic and nuclear physics * Principles of wave mechanics * Principles of Particle physics   1.2 Demonstrated ability to:   * measure and calculate dimensions of space * measure and calculate forces * determine velocity * measure and calculate acoustic frequencies * measure and calculate time * determine rates of heat transfer * generate electromagnetic fields * measure and calculate electrostatic force * construct basic electric circuits * construct basic electronic circuits |
| 1. Resource Implications | The following resources should be provided:   * 1. Access to relevant workplace or appropriately simulated environment where assessment can take place   2. Measuring tools and equipment   3. Sample materials to be tested |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Observation   2. Oral Questioning   3. Written tests   4. Individual project   5. Third party report |
| 1. 4. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the-job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## CONDUCT RESEARCH

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

**UNIT DESCRIPTION**

This unit covers the competencies required to conduct research. It involves developing research proposal, collecting research data, analysing and processing research data and presenting research findings.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Develop research proposal | 1. Research problem is identified based on research gap or interest. 2. Research title is formulated based on research problem. 3. Research objectives are formulated based on the research title. 4. Background information on the research problem is sought based on research title. 5. Research problem is stated based on the research title. 6. Literature is reviewed based on the research problem as per scientific research requirements. 7. Research design and methodology are determined based on the research objectives as per scientific research requirements. 8. Research proposal is written and presented based on institution’s format and scientific research requirements. |
| 1. Develop research budget proposal and work plan | 1. direct costs are determined and estimated as per the research design 2. indirect cost is determined and estimated as per the research design 3. the budget narratives are captured as per the cost estimates 4. total estimates are made and captured as per the cost estimates 5. time plan is developed as per stipulated time |
| 1. Collect research data | * 1. ***Data collection tools*** are developed based on research methodology.   2. Data collection tools are piloted/tested as per scientific research requirements.   3. Research data is collected based on research methodology and scientific research requirements.   4. ***Research data*** is collated based on research methodology and scientific research requirements. |
| 1. Analyse and process research data | * 1. Research data is analysed based on research objectives as per scientific research requirements and data analysis plan.   2. Data processing techniques are applied as per the procedures.   3. Research data is processed in accordance with scientific research requirements. |
| 1. Present research findings | * 1. Research findings are presented and interpreted according to scientific research requirements.   2. Research report is compiled and written as per scientific research requirements.   3. Citations are made based on source of information.   4. Referencing is done as per citations.   5. Conclusions are drawn and recommendations made based on research findings and scientific research requirements.   6. Research findings are disseminated based on institution’s policy and scientific research requirements. |

**RANGE**

This section provides work environment and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Data collection tools may include but not limited to: | * Geological mapping tools * Density mapping tools * Magnetic mapping tools * Seismic mapping tools * Resistivity mapping tools * Logging tools * Maps * Graph papers * laptops |
| 1. Research data may include but not limited to: | * Primary data * Secondary data |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Interpersonal
* Communication
* Time management
* Stress management
* Analytical
* Creative thinking
* Problem solving
* Negotiation
* Report writing
* Public relations
* ICT

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Research principles
* Geophysical principles
* Map reading and interpretation
* Geophysical data analysis and processing using software
* Interpretation of geophysical data and models
* Geophysical report writing

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   1. Identified geophysical research problem properly. 2. Formulated research title correctly. 3. Formulated research objectives appropriately. 4. Sought background information on the research problem appropriately. 5. Stated research problem correctly. 6. Reviewed literature correctly 7. Determined research design and methodology appropriately 8. Written research proposal correctly. 9. Presented Research proposal correctly 10. Developed data collection tools appropriately 11. Piloted data collection tools correctly 12. Collected research data correctly 13. Collated research data appropriately 14. Analysed research data properly 15. Processed research data correctly 16. Presented research findings appropriately 17. Interpreted research findings appropriately 18. Compiled research report accordingly 19. Drew conclusions precisely. 20. Made recommendations appropriately. 21. Disseminated research findings appropriately. |
| 1. Resource Implications | The following resources should be provided:   1. Appropriately simulated environment where assessment can take place. 2. Access to relevant assessment environment. 3. Resources relevant to the proposed assessment activity or tasks. 4. Library 5. Internet connectivity |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Oral questioning 2. Written tests 3. Individual projects 4. Interviews 5. Observation 6. Portfolio 7. Third party reports |
| 1. Context of Assessment | Competency may be assessed   1. On-the-job 2. Off-the-job 3. During industrial attachment. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# CORE UNITS OF COMPETENCY

## DEVELOP MINE DESIGN

**UNIT CODE: MI**N/OS/MT/CR/01/6/A

**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.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Develop mineral block model | * 1. ***Geological data*** is interpreted based on geological report.   2. Geological database is created and data imported based on geological data.   3. Sectioning and digitizing is done based on ore distribution.   4. Compositing is done based on ore distribution.   5. Ore model is created based on geological data and software specifications.   6. ***Geostatistics*** analysis is done based on geological data and software specifications   7. Block model is created using ***modeling*** ***software*** based on geological data. |
| 1. Determine mine plant and equipment | * 1. Open cast or underground mining method is selected based on geotechnical data and geological data.   2. ***Mining tools and equipment*** are identified and selected according to mining method, tonnage, ore grade and cost.   3. Processing plant location is selected based on mine conditions, distance and cost.   4. ***Method of processing*** is selected based on ore characteristics   5. Processing plant equipment is selected based on method of processing and ore characteristics |
| 1. Determine mine workforce | * 1. Life of a mine is determined based on block model.   2. Mining tasks are identified within the mine based on organizational procedures.   3. Workforce is identified and selected based on organizational procedures. |
| 1. Design mine ventilation system | * 1. Mining methods are identified based on block model   2. ***Ventilation method*** is selected based on ore body characteristics   3. Mine ventilation circuit and networks is designed based on ventilation method   4. Ventilation system is designed based on ISO4001 standards.   5. Potential environmental impacts of ventilation systems are assessed based on tailing material and NEMA regulations. |
| 1. Design mine dewatering system | * 1. Mining methods are identified based on ore characteristics.   2. Source of mine water is established based on geological formation of the area   3. Amount of mine water is determined based on lithology.   4. Size of sump is determined based on amount of mine water.   5. Pump specifications is determined based on amount of mine water and depth of the mine.   6. Collection pond is designed according to size of sump.   7. Potential environmental impacts of dewatering system are assessed based on tailing material and NEMA regulations. |
| 1. Design mine haulage infrastructure | * 1. Mining methods are identified based on ore deposit.   2. The ore reserve is quantified based on block model   3. ***Haulage system*** is determined based on ore reserve and geology of the area.   4. Haulage equipment’s are identified and selected based on job requirements   5. Type of haul road is determined based on mining method   6. Potential environmental impacts of mine haulage infrastructure are assessed based on tailing material and NEMA regulations. |
| 1. Design mine crushing unit | * 1. Type of ***crushers*** is determined based on lithology and client specifications.   2. Power of the crusher is determined based on job requirements   3. Reduction ratio is identified based on manufacturer’s specifications.   4. Mobility of the crusher is determined according to mine life.   5. Potential environmental impacts of tailing dams are assessed based on tailing material and NEMA regulations. |
| 1. Design mine access infrastructure | * 1. Mining methods are identified and selected based on ore deposit.   2. Mining equipment’s is selected according to mining method   3. Shaft is designed according to geology of the ore body and mining method   4. Haul roads are designed according to geology of ore body and mining method   5. ***Mine access methods*** are determined based on equipment’s   6. Potential environmental impacts of mine access infrastructure are assessed based on tailing material and NEMA regulations. |
| 1. Prepare schematic mine layout | * 1. Aerial photographs and satellite images are obtained according to organizational procedures   2. Aerial photographs and satellite images are interpreted according to photogrammetry regulations and best practice.   3. ***Mine infrastructure*** is positioned based on geology of the area   4. Mine layout is designed according to organizational procedures |
| 1. Design tailing dams | * 1. Tailing dam position is determined according to mine layout and topography.   2. Tailing dam capacity is determined based on ore body size and size of processing plant.   3. Tailing dam type is selected based on ore body characteristics   4. Potential environmental impacts of tailing dams are assessed based on tailing material and NEMA regulations.   5. Closure strategy of tailing dam is designed based on mine life and ore characteristics.   6. Occupational safety is observed based on OSHA 2007. |
| 1. Design mine stockpiles | * 1. Stockpiles position is determined according to mine layout and topography.   2. Stockpiles capacity is determined based on ore body size and size of processing plant.   3. Stockpiles types is selected based on ore body characteristics   4. Potential environmental impacts of stockpiles are assessed based on tailing material and NEMA regulations. |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Geological data may include but not limited to: | * Survey * Collar * Assay * Lithology |
| 1. Geostatistics analysis may include but not limited to: | * Basic statistics * Variogram * Estimation methods * Kriging * Inverse Distance Weighted method |
| 1. Software may include but not limited to: | * Datamine * Surpac * Netpro mine |
| 1. Mining tools and equipment may include but not limited to: | * Excavator * Loaders * Load haul dump (LHD) * Dragline * Slasher * Drill rigs |
| 1. Processing methods may include but not limited to: | * Magnetic separation * Pressure leaching * Froth flotation * Gravity concentration |
| 1. Ventilation method may include but not limited to: | * Natural * Auxiliary * Booster |
| 1. Haulage system may include but not limited to: | * Locomotives * Hoisting systems * Conveyer belts |
| 1. Haulage equipment’s may include but not limited to: | * Trucks * Front end loaders * LHD * Friction hoist |
| 1. Crushers may include but not limited to: | * Jaw * Impact * Roller * Pulveriser * Gyratory |
| 1. Mine access methods may include but not limited to: | * Haul roads * Vertical shafts * Adit * Horizontal Shaft |
| 1. Mine infrastructure | * Processing plant * Tailing dams * Stockpiles * Headframe |

**Required Skills**

The individual needs to demonstrate the following skills:

* Interpreting geological data
* Interpreting aerial photographs and satellite imagery
* Creating DTMs
* Performing Sectioning and Digitizing
* Using mining software’s
* Analysis using geostatistical methods
* Designing mining systems
* Performing compositing

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Ventilation methods
* Types of crushers
* Analysis using geostatistical methods
* Mineral processing methods
* Mining methods
* Mining tools and equipment
* Impacts of mining on the environment
* Mine set up
* Basic geology

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Developed mineral block model   2. Determined mine plant and equipment   3. Determined mine workforce   4. Designed mine ventilation system   5. Designed mine dewatering system   6. Designed mine haulage infrastructure   7. Designed mine crushing unit   8. Designed mine access infrastructure   9. Prepared schematic mine layout   10. Designed tailing dams   11. Designed mine stockpiles   12. Assessed environmental impacts of extraction and processing |
| 1. Resource implications | ***The following resources must be provided:***  2.1 Fabrication workplace meeting OSHA standards  2.2 Tools and equipment relevant to the tasks |
| 1. Methods of assessment | Competency may be assessed through:   * 1. Observation   2. Oral questioning   3. Written tests   4. Practicals |
| 1. Context of assessment | Candidate will be assessed individually in an actual  workplace or in closely simulated work environment. |
| 1. Guidance information for assessment. | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## MANAGE MINE HEALTH, SAFETY AND ENVIRONMENT

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

**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.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key  outcomes which make up  workplace function | **PERFORMANCE CRITERIA**  These are assessable statements which speify the required level of performance for each of the elements  ***(Bold and italicized terms are elaborated in the Range)*** |
| 1. Hold safety briefs meetings | * 1. Time for the meeting is allocated in accordance with organizational procedures   2. Agenda of the meeting is identified based on organizational procedures and tasks   3. Key issues affecting safety are addressed according to safety regulations |
| 1. Provide safety equipment | * 1. Potential risks and hazards are identified based on task requirements, geotechnical and geological data.   2. ***PPEs*** are identified based on the task requirements   3. Safety equipment are obtained based on the task requirements |
| 1. Evacuate the mine | * 1. Mining method is identified based on ore deposit and depth.   2. ***Evacuation tools and equipment*** are identified based on mining method and safety regulations   3. Risk areas are identified based on mining method and ore characteristics.   4. Emergency exits are established based on mining method and risk areas   5. Evacuation and emergency procedures are established based on safety regulations.   6. Emergency drills are planned and conducted based on level of risk identified. |
| 1. Sensitize the community | * 1. Potential hazards are identified based on ore characteristics, geology and geotechnical properties of the area.   2. The surrounding community is identified based on proximity and prevalence to mine hazard.   3. Surrounding community is sensitized on safety based on NEMA regulations and standard operating procedures. |
| 1. Control environmental pollution | * 1. Mining method is identified based on ore characteristics and geology.   2. Potential ***pollution risks*** are assessed based on ore characteristics   3. ***Control methods*** are established based on safety regulations   4. Control methods are designed based on NEMA regulations   5. Environmental baseline study is carried out as per NEMA regulations   6. Environmental monitoring methods are established based on organisational procedures and NEMA regulations   7. Continuous monitoring and assessment of environmental conditions is done based on NEMA regulations and organisational procedures |
| 1. Build staff capacity | * 1. Mining tasks are established based on organisational procedures   2. PPEs are obtained based on task requirements   3. Staff is sensitized on safety and operational procedures based on organisational procedures   4. Staff is insured according to industry, organisational procedures and NEMA regulations |
| 1. Monitor community’s health | * 1. Surrounding community is identified based on proximity.   2. Potential health risks are identified based on ore characteristics and operational procedures   3. Baseline data on the health of the community is collected according to KEBS   4. Health monitoring programs are established based on NEMA regulations   5. Periodic assessment of community health is done based on NEMA regulations   6. Community health data is recorded and documented according to organisational procedures |
| 1. Rehabilitate mine site environment | * 1. An Environmental management system is designed based on ISO14001 standard.   2. Mine waste issues are addressed based on mining regulations.   3. Mine facilities are dismantled based on NEMA regulations   4. Rehabilitation and reclamation is done according to NEMA regulations.   5. Continuous improvements is done based on mine regulations |

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

**RANGE**

| **Variable** | **Range** |
| --- | --- |
| 1. PPEs may include but not limited to: | * + Gloves   + Goggles   + Helmets   + Safety boots   + Earmuffs   + Dust masks |
| 1. Evacuation tools and equipment may include but not limited to: | * + Fire extinguishers   + Fire alarms   + Gas detectors   + UHF   + Signage |
| 1. Pollution risks may include but not limited to: | * + Leaching   + Acid mine drainage   + Mine gas   + Mine dust |
| 1. Control methods may include but not limited to: | * + Water treatment   + Dust suppression   + Dilution   + Isolation |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Statutory compliance
* Initial response first aid
* Responses to local emergencies and incidents
* Basic geological data
* Types and uses of personal protective equipment
* Gas detection and monitoring
* Evacuation tools and equipment

**Required skills**

The individual needs to demonstrate the following skills:

* + Report writing
  + Communication
  + Ability to use PPEs
  + Problem solving
  + Ability to use evacuation equipment

**EVIDENCE GUIDE**

This section provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Identified and used safety equipment   2. Adhered to statutory regulations   3. Identified and used evacuation tools and equipment   4. Identified potential hazards and sensitized the community   5. Held safety briefs meetings   6. Sensitized the community   7. Controlled environmental pollution   8. Built staff capacity   9. Monitored community’s health   10. Rehabilitated mine site environment |
| 1. Resource implications | The following resources must be provided:   * 1. PPEs   2. Projector   3. Computer   4. Reference materials   5. Tools and equipment   6. Internet connectivity   7. Workshops |
| 1. Methods of assessment | Competency may be assessed through:   * 1. Practical   2. Observation   3. Oral questioning   4. Written tests |
| 1. Context of assessment | Candidate will be assessed individually in an actual workplace or in closely simulated work environment. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## MANAGE DRILLING AND BLASTING OPERATIONS

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

**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.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Develop blast design | * 1. Mining method is identified based on ore body   2. Drilling and blasting operation is established based on rock properties, ore characteristics and organizational procedures   3. Drilling and blasting equipment’s are identified based on task requirements   4. Explosive materials are identified based on geology and ore characteristics   5. PPEs are identified and obtained based on task requirements   6. ***Blast pattern*** is established based on geology and ore characteristics   7. Drilling operation is done based on blast pattern   8. Safety procedures are observed based on OSHA and NEMA regulations |
| 1. Execute drilling operation | * 1. ***Drilling equipment*** is identified based on geology and ore characteristics   2. Drilling program is established based on geology and ore characteristics   3. Drilling monitoring plan is executed based on drilling outcome.   4. Drilling safety risks are assessed based on drilling operations and NEMA regulations   5. PPEs are identified based on drilling operation and NEMA regulations   6. Safety procedures are assessed based on OSHA regulations   7. Drilling incidents and accidents are recorded based on OSHA standards |
| 1. Carry out blasting operation | * 1. ***Blasting method*** is determined based on geology and operational procedures   2. ***Blasting equipment*** are identified and obtained based on geology and NEMA regulations B   3. Appropriate transportation and handling methods for explosives are identified   4. ***Blasting materials*** requirements are identified against mine requirements, NEMA regulations and task requirement   5. Blasting is executed based on standard operating procedures   6. Safety procedures are observed based on OSHA regulations   7. Sample blasted material based on operational procedures   8. Blasting information is recorded based on operational procedures and NEMA regulations   9. Monitoring procedure for blasting is established based on mining regulations |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| 1. Blast patterns may include but not limited to | * + Single row   + Multi row   + Parallel cut   + V cut   + Fan cut |
| 1. Blasting methods may include but not limited to | * + Electrical method   + Non- electrical method |
| 1. Blasting materials and equipment may include but not limited to | * + Anfo   + Primer   + Detonator   + Booster   + Blasting machine |
| 1. Drilling equipment may include but not limited to | * + Drilling rig   + Compressors   + Pumps   + Bits   + Rod   + Fluid |

**REQUIRED KNOWLEDGE**

The individual needs to demonstrate knowledge of:

* Blast design criteria
* Characteristics and applications of blasting products
* Blasting materials
* Blasting patterns
* Drilling Equipment’s
* Regulations governing blasting
* Legal requirements

**REQUIRED SKILLS**

The individual needs to demonstrate the following skills:

* + Recording
  + Designing blast design
  + Ability to drill
  + Blasting
  + Handling mine software

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Developed blast design   2. Identified blasting materials   3. Identified blasting methods   4. Identified drilling equipment   5. Carried out drilling operations   6. Observed drilling and blasting operational procedures |
| 1. Resource implications | The following resources must be provided:   * 1. Reference materials   2. Software for blast design   3. PPEs   4. Computers   5. Equipment |
| 1. Methods of assessment | Competency may be assessed through:   * 1. Practical   2. Observation   3. Oral questioning   4. Written tests |
| 1. Context of assessment | Candidate will be assessed individually in an actual workplace or in closely simulated work environment or during industrial attachment |
| 1. Guidance information for assessment. | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## MANAGE LOADING AND HAULAGE OPERATIONS

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

**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, recording and monitoring loading and hauling operations. These operations are critical in the mining industry.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Provide loading and hauling equipment | * 1. Mining method is identified based on geology and ore characteristics   2. ***Loading and haulage equipment*** are identified and obtained based on mining method, geology, depth and organizational procedures   3. Loading and haulage requirements are obtained based on task requirements   4. Loading and haulage equipment are used based on job specifications and ore characteristics |
| 1. Maintain loading and hauling equipment and records | * 1. Loading and haulage tasks are identified based on mining method   2. Loading and hauling equipment are selected based on task requirements   3. Loading and hauling equipment maintenance information is recorded based on organizational procedures   4. Loading and hauling equipment fleet information is recorded based on organizational procedures |
| 1. Monitor loading and hauling operation | * 1. Loading and hauling equipment are identified based on geology and job requirements   2. Safety risks are assessed based on OSHA regulations   3. PPEs are obtained based on task requirements and SOPSs   4. Loading and hauling incidents and accidents are recorded and assessed based on organizational procedures  1. Loading and hauling operations are monitored based on organizational procedures |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| 1. Loading equipment may include but not limited to: | * Front end loaders * Loading shovel * Draglines * Hydraulic excavator |
| 1. Haulage equipment may include but not limited to: | * Hoisting systems * Conveyer belts * Trucks * Front end loaders * LHD * Friction hoist |

**REQUIRED KNOWLEDGE**

The individual needs to demonstrate knowledge of:

* Loading and hauling equipment
* Loading operations
* Haulage operations
* Safety procedures
* Maintenance procedures

**REQUIRED SKILLS**

The individual needs to demonstrate the following skills:

* + Record keeping
  + Communication
  + Loading
  + Haulage
  + Using mine software

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Identified haulage equipment   2. Identified loading equipment   3. Developed maintenance schedule   4. Identified mine methods   5. Recorded loading and hauling incidents and accidents |
| 1. Resource implications | The following resources must be provided:   * 1. Reference materials   2. Mine software   3. Computer with internet connectivity   4. Workshop with fully equipped tools and equipment |
| 1. Methods of assessment | Competency may be assessed through:   * 1. Observation   2. Oral questioning   3. Written tests   4. Practicals |
| 1. Context of Assessment | Candidate will be assessed individually in an actual  workplace or in closely simulated work environment. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## MANAGE ORE CRUSHING OPERATION

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

**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.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Provide ore crushing equipment. | * 1. ***Processing operations*** are identified based on ore characteristics, Job specialization and manufacturers specifications   2. ***Processing equipment*** is identified and obtained based on processing operations and ore characteristics   3. ***Screen size*** is analyzed based on job requirement and ore characterization   4. ***Ore crushing equipment*** is assigned based on ore characteristics, Job specifications and manufacturers specifications   5. Ore crushing requirement are obtained based on ore crushing equipment and manufacturers description |
| 1. Maintain ore crushing equipment and records | * 1. Identify ore crushing equipment based on ore characteristics and manufacturers specifications   2. Ore crushing equipment information are maintained based on manufacturers specifications and organizational procedures   3. Ore crushing equipment records are maintained based on organizational procedures |
| 1. Monitor ore crushing operations | * 1. Ore crushing equipment’s are identified based on ore characteristics and organizational procedures   2. Safety procedures are assessed based on OSHA regulations   3. PPEs are Identified based on crushing operations and NEMA regulations   4. Ore crushing incidents and accidents are recorded based on crushing operations   5. ***Ore crushing operations*** are monitored based on organizational procedures and manufacturers specifications |
| 1. Maintain Ore samples | * 1. Ore samples are identified based on organization procedures and job requirement   2. Ore samples are recorded based on organizations procedures and job requirement   3. Ore samples are periodically assessed based on organization procedures and job requirement   4. Safety procedures are followed based on ore characteristics, organization procedures and NEMA regulations.   5. PPEs are identified based on ore characteristics and NEMA regulations |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| 1. Processing equipment may include but not limited to: | * + Hydro cyclone   + Centrifuge   + Gravity concentrators   + Screen   + Classifiers |
| 1. Processing operations may include but not limited to: | * + Crushing   + Dewatering   + Milling   + Grinding   + Separation   + Froth flotation |
| 1. Screen size may include but not limited to: | * + Primary crusher screens   + Secondary crusher screens   + Tertiary crusher screens |
| 1. Ore crushing equipment may include but not limited to: | * + Jaw   + Impact   + Roller   + Pulveriser   + Gyratory |
| 1. Ore crushing operations may include but not limited to: | * + Feeding   + Crushing   + Screening |

**REQUIRED KNOWLEDGE**

The individual needs to demonstrate knowledge of:

* + Crushing equipment
  + Screens
  + Crushing operations
  + Safety procedures
  + Maintain crushing records
  + Basic Mechanics

**REQUIRED SKILLS**

The individual needs to demonstrate the following skills:

* + Screen size analysis
  + Sampling
  + Record keeping
  + Operating crushers

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Identified crushing equipment   2. Analysed screen sizes   3. Identified ore crushing requirements   4. Operated crushing equipment   5. Maintained crushing records   6. Observed safety procedures   7. Identified proper PPEs   8. Monitored crushing operations   9. Recorded crushing incidents   10. Maintained ore samples |
| 1. Resource implications | The following resources must be provided:   * 1. Reference materials   2. Crushing equipment   3. Samples and sampling materials   4. Safety equipment (PPEs) |
| 1. Methods of assessment | Competency may be assessed through:   * 1. Observation   2. Practical test   3. Oral questioning   4. Written tests   5. Projects |
| 1. Context of Assessment. | Candidate will be assessed individually in an actual  workplace or in closely simulated work environment or during industrial attachment |
| 1. Guidance information for assessment. | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## MANAGE MINE GROUND STABILIZATION

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

**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.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Provide ground stabilizing operation equipment | * 1. Mining method is identified based ore characteristics and geology of the area   2. Ground support and stabilizing methods are identified based on mining methods   3. Ground support equipment are identified and obtained based on ground support method, geology of the area and geotechnical properties of surrounding rocks   4. Ground support equipment are used based on ground support method and rock geotechnical properties   5. Ground stabilizing operation materials are obtained based on ground support method and geotechnical properties |
| 1. Monitor ground stabilizing operations | * 1. Ground stabilizing methods are identified and assessed based on method of mining, geology and rock geotechnical properties.   2. Ground stabilizing methods are designed based on method of mining, geotechnical properties and NEMA regulations   3. Potential safety risks are identified and assessed based on geotechnical properties   4. Ground stabilizing operation incidents are established and recorded based on safety regulations and organizational procedures   5. Ground stabilizing operation records are maintained based on safety regulation and organization procedures   6. PPEs and safety procedures are observed based on OSHA regulations |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| 1. Ground Support Methods may include but is not limited to: | * Rock bolts * Short creting * Back filling * Timbering |
| 1. Stabilization equipment may include but is not limited to: | * Short creting cranes * Meshes * Rock bolts |
| 1. Ground stabilizing materials may include but is not limited to: | * Cement * Lime * Soils * Fly Ash |
| 1. Geotechnical Properties may include but is not limited to: | * Particle size distribution * Plasticity * Shear strength |

**REQUIRED SKILLS**

The individual needs to demonstrate the following skills:

* + Record keeping
  + Equipment Maintenance
  + Mine layout
  + Short-creting

**REQUIRED KNOWLEDGE**

The individual needs to demonstrate knowledge of:

* + Ground support methods
  + Mine layout
  + Ground stabilizing equipment
  + Maintaining stabilizing equipment
  + Rock geotechnical properties
  + Basic geology

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Identified mining method   2. Identified and used ground stabilization equipment   3. Observed environmental regulations   4. Assessed potential safety risks   5. Assessed potential incidents and risks |
| 1. Resource implications | The following resources must be provided:   * 1. Tools and equipment   2. Computer   3. Internet connectivity   4. Equipped workshop   5. Reference materials |
| 1. Methods of assessment | Competency may be assessed through:   * 1. Observation   2. Oral questioning   3. Written tests |
| 1. Context of Assessment | Candidate will be assessed individually in an actual  workplace or in closely simulated work environment. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## MANAGE MINE FLUID FLOW

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

**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.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Establish Mine Ventilation System. | * 1. Mining method is identified based on the ore body characteristics and depth.   2. Potential mine hazardous areas are identified based on the ore characteristics.   3. Mine airflow is determined based on the depth of the mine and aerodynamics.   4. ***Mine ventilation system*** is established based on mine airflow, ore body characteristics and geology. |
| 1. Establish Mine Dewatering System | * 1. Mining methods are identified based on the ore body characteristics.   2. Mine layout is determined based on ore characteristics and mining method.   3. Sources of mine water is established based on the geological formations.   4. Volume of mine water is established based on the lithology.   5. Sump size is determined based on the volume of mine water.   6. ***Pump*** specification is determined based on volume of mine water and depth of mine.   7. Collection pond capacity is established based on the sump size.   8. Suitable mine dewatering system is established based on amount of mine water, pump specification and mining method. |
| 1. Establish Mine Degasification System. | * 1. Mining method is established based on ore characteristics and depth.   2. ***Potential gas hazardous areas*** are identified according to ore characteristics and geology.   3. ***Gas emitted*** is sampled and identified based on ore characteristics and geology.   4. Degasification equipment are identified and selected based on gas emitted.   5. Mine ***Degasification system*** is established based ore characteristics and NEMA regulations. |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Degasification system may include but not limited to: | * In-seam drainage * Gob drainage and surface boreholes * Drainage from worked out areas. * Cross measures drainage. |
| 1. Pumps may include but not limited to: | * Centrifugal * Diaphragm * Pistol * Gear * Submersible |
| 1. Mine ventilation system may include but not limited to: | * Fans * Air inlet * Ducts * Heating/cooling equipment * Air filtering equipment * air distribution registers |
| 1. Potential gas hazardous areas may include but is not limited to: | * Working face * Diapir * Processing plant * Tailing storage facilities * Coal seams * Roof and floor * Machines |
| 1. Gas emitted may include but not limited to: | * CO2 * Hydrogen sulphide * Methane * CO * RADON |

**Required Skills**

The individual needs to demonstrate the following skills:

* Sampling
* Dewatering systems.
* Degasification systems.
* Ventilation systems.
* Equipment operation.

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Ventilation systems.
* Gas monitoring and detection.
* Dewatering systems.
* Mine gases
* Basic geology.
* Mine water.
* Mine setup/layout.

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Established ventilation system.   2. Established dewatering systems.   3. Identified sources of mine water.   4. Monitored mine airflow.   5. Identified mining method. |
| 1. Resource implications | ***The following resources must be provided:***   * 1. Equipment.   2. Computers.   3. Mine software.   4. Reference materials.   5. Stationery. |
| 1. Methods of assessment | Competency may be assessed through:   * 1. Observation   2. Oral questioning   3. Written tests   4. Practicals |
| 1. Context of assessment | Candidate will be assessed individually in an actual workplace or in closely simulated work environment or during industrial attachment. |
| 1. Guidance information for assessment. | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## PERFORM MINE SURVEY

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

**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.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Conduct mine reconnaissance | * 1. Mining operation is identified based on job requirements   2. Climatic condition of the area is assessed based on meteorological data   3. Geology of the area is established based on geological data   4. Mine ***survey equipment*** are identified and obtained based on the mining operation, climatic condition and geology of the area |
| 1. Conduct hydrographic survey | * 1. ***Hydrographic operations*** are identified based on job requirements   2. Hydrographic survey equipment are identified based on operations   3. ***Maritime zones*** are identified based on united nations conventions on the law of the sea (UNCLOS)   4. ***Coordinate reference systems*** are determined based on real-world position   5. Control points are established based on known georeferenced location   6. ***Errors*** are identified based on survey equipment   7. ***Corrections*** are applied based on survey equipment and errors obtained   8. Safety measures are established based on survey operations   9. Area to be covered is identified based on job requirements |
| 1. Conduct traversing operations | * 1. Mining operation is identified based on task requirements   2. Survey equipment are identified based on mining operations   3. ***Control points*** are established based on known georeferenced location   4. ***Transfer of horizontal control points*** is done based on task requirement   5. Errorsare identified based on survey equipment   6. Corrections are applied based on survey equipment and errors obtained   7. Survey equipment are handled and maintained based on manufacturers specifications |
| 1. Conduct levelling operations | * 1. Mining operation is identified based on task requirements   2. ***Type of levels*** are identified and selected based on job requirement and manufacturers specifications   3. Control points are established based on known georeferenced location   4. ***Levelling methods*** are conducted based on mining operations   5. Errors in levellingare identified based on ***sources of error***   6. Corrections are applied based on survey equipment and errors obtained |
| 1. Interpret contour maps | * 1. Reduced levels are obtained based on levelling computations   2. Contour interval values are established based on standard reference values   3. Contour maps are drawn based on reduced levels and contour values   4. ***CAD software*** are used to draw contours based on manufacturers manual   5. Contour maps are interpreted based on task requirements |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Errors may include but not limited to: | * Gross * Systematic * Random |
| 1. Corrections may include but not limited to: | * Slope correction * Geometrical * Meteorological corrections |
| 1. Hydrographic operations may include but not limited to: | * Dredging * Water supply * Hydropower generation * Construction of dams and bridges * Irrigation |
| 1. Coordinate reference systems may include but not limited to: | * Geocentric Cartesian coordinate system * Geographic/ geodetic coordinate system * Projected/plane coordinate system |
| 1. Maritime zones may include but not limited to: | * Territorial sea * High seas * Continental shelf * Contiguous zone |
| 1. Control points may include but is not limited to: | * Horizontal * Vertical |
| 1. Transfer of horizontal control points may include but is not limited to: | * Traverse by two or more adits or slopes * By means of plumb lines in more than one shaft * By means of two or more plumb lines in more than one shaft * By means of transit traverse down a shaft |
| 1. Survey equipment may include but not limited to | * Theodolite * Total station * Level machine * Staff * GPS * Gyro theodolite * Lasers |
| 1. Levelling methods may include but is not limited to: | * Height of collimation * Rise and fall |
| 1. Type of levels may include but is not limited to: | * Dumpy * Tilting * Automatic * Y level |
| 1. Sources of error may include but is not limited to: | * Natural * Personal * Instrumental |
| 1. CAD software may include but is not limited to: | * Arcgis * ESurvey CAD * Surfer |

**Required Skills**

The individual needs to demonstrate the following skills:

* ability to use surveying equipment
* setting up of survey equipment
* error analysis
* ability to use computer survey software
* drawing contours
* interpreting
* computational

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* survey equipment
* methods of plotting contours
* types and sources of errors
* types of levels
* traversing methods
* hydrographic survey
* geographic reference system
* methods of reduction of levels

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Identified and selected survey equipment   2. Conducted reconnaissance survey   3. Identified maritime zones   4. Identified geographical reference system   5. Conducted traversing   6. Transferred horizontal controls   7. Plotted contour maps |
| 1. Resource implications | ***The following resources must be provided:***   * 1. Survey equipment.   2. Booking sheet   3. Computers.   4. Mine software.   5. Reference materials.   6. Stationery. |
| 1. Methods of assessment | Competency may be assessed through:   * 1. Observation   2. Oral questioning   3. Written tests   4. Practicals |
| 1. Context of assessment | Candidate will be assessed individually in an actual  workplace or in closely simulated work environment or during industrial attachment. |
| 1. Guidance information for assessment. | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |