

**REPUBLIC OF KENYA**

**NATIONAL OCCUPATIONAL STANDARDS**

**FOR**

**BIOTECHNICIAN**

**LEVEL 6**



TVET CDACC

P.O. BOX 15745-00100

NAIROBI

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# FOREWORD

The provision of quality education and training is fundamental to the Government’s overall strategy for social economic development. Quality education and training will contribute to achievement of Kenya’s development blueprint, Vision 2030 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 in the Constitution of Kenya 2010 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 developing a competency-based curriculum for Biotechnology leve 6. These Occupational Standards will also be the basis 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 Biotechnology sector’s growth and 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 Sessional Paper No. 14 of 2016 on Reforming Education and Training in Kenya, emphasized the need to reform curriculum development, assessment and certification. This called for a 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 labor force.

The TVET Curriculum Development, Assessment and Certification Council (TVET CDACC), in conjunction with Biotechnology Sector Skills Advisory Committee (SSAC) have developed these Occupational Standards for Biotechnician level 6. These standards will be the bases for development of competency-based curriculum for Biotechnician.

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, Biotechnology SSAC, expert workers and all those who participated in the development of these Occupational Standards.

**CHAIRPERSON,**

**TVET CDACC**

# ACKNOWLEDGMENT

These Occupational Standards were developed through combined effort of various stakeholders from private and public organizations. I am 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 Biotechnology 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.

My gratitude also goes to the Ministry of Industrialization which enabled the development of these Standards through the industry experts.

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

**CHAIRPERSON**

**BIOTECHNOLOGY SECTOR SKILLS ADVISORY COMMITTEE**

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# **ACRONYMS AND ABBREVIATIONS**

BC Basic Competency

BT Biotechnology

CBET Competency Based Education and Training

CC Core Competency

CO Common Units

CDACC Curriculum Development Assessment and Certification Council

A Control Version

MED Medical

OS Occupational Standards

OSHA Occupation Safety and Health Act

PPE Personal Protective Equipment

SOP Standard operating procedures

SSAC Sector Skills Advisory Committee

TVET Technical and Vocational Education and Training

# KEY TO UNIT CODE

**MED/OS/BT/BC/01/6/A**

Industry or sector

Occupational Standards

Occupational area

Type of competency

Competency number

Competency level

Control version

# OVERVIEW

The Biotechnician level six qualification consist of competencies that a person must achieve to conduct research project, apply molecular biology, apply biometrics, demonstrate knowledge of human anatomy, conduct biotechnology research, manage industrial waste, manage livestock production, manage plant production, manage food processing, manage Biotechnology laboratory andperform genetic engineering.

**BASIC UNITS OF COMPETENCY**

|  |  |
| --- | --- |
| **UNIT CODE** | **UNIT TITLE** |
| MED/OS/BT/BC/01/6/A | Demonstrate communication skills |
| MED/OS/BT/BC/02/6/A | Demonstrate numeracy skills |
| MED/OS/BT/BC/03/6/A | Demonstrate digital literacy |
| MED/OS/BT/BC/04/6/A | Demonstrate entrepreneurial skills |
| MED/OS/BT/BC/05/6/A | Demonstrate employability skills |
| MED/OS/BT/BC/06/6/A | Demonstrate environmental literacy |
| MED/OS/BT/BC/07/6/A | Demonstrate occupational safety and health practices |

**COMMON UNITS OF COMPETENCY**

|  |  |
| --- | --- |
| **UNIT CODE** | **UNIT TITLE** |
| MED/OS/BT/CC/01/6/A | Conduct research project |
| MED/OS/BT/CC/02/6/A | Apply molecular biology |
| MED/OS/BT/CC/03/6/A | Apply biometrics |
| MED/OS/BT/CC/04/6/A | Demonstrate knowledge of human anatomy |

**CORE UNITS OF COMPETENCY**

|  |  |
| --- | --- |
| **UNIT CODE** | **UNIT TITLE** |
| MED/OS/BT/CR/01/6/A | Conduct Biotechnology research |
| MED/OS/BT/CR/02/6/A | Manage media culture preparation |
| MED/OS/BT/CR/03/6/A | Manage industrial waste |
| MED/OS/BT/CR/04/6/A | Manage livestock production |
| MED/OS/BT/CR/05/6/A | Manage plant production |
| MED/OS/BT/CR/06/6/A | Manage food processing |
| MED/OS/BT/CR/07/6/A | Manage Biotechnology laboratory |
| MED/OS/BT/CR/08/6/A | Perform genetic engineering |

# BASIC UNITS OF COMPETENCY

# DEMONSTRATE COMMUNICATION SKILLS

**UNIT CODE:** MED/OS/BT/BC/01/6/A

**UNIT DESCRIPTION**

This unit covers the competencies required in meeting communication needs of clients and colleagues; developing, establishing, maintaining communication pathways and strategies. It also covers competencies for conducting interview, facilitating group discussion and representing the organization in various forums.

**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 | 1.1 Specific communication needs of clients and colleagues are identified and met  1.2 Different approaches are used to meet communication needs of clients and colleagues  1.3 Conflict is addressed promptly and in a timely way and in a manner, which does not compromise the standing of the organization |
| 1. Develop communication strategies | * 1. Strategies for effective internal and external dissemination of information are developed to meet the organization’s requirements   2. Special communication needs are considered in developing strategies to avoid discrimination in the workplace   3. Communication ***strategies*** are analyzed, evaluated and revised where necessary to make sure they are effective |
| 1. Establish and maintain communication pathways | * 1. Pathways of communication are established to meet requirements of organization and workforce   2. Pathways are maintained and reviewed to ensure personnel are informed of relevant information |
| 1. Promote use of communication strategies | * 1. Information is provided to all areas of the organization to facilitate implementation of the strategy   2. Effective communication techniques are articulated and modelled to the workforce   3. Personnel are given guidance about adapting communication strategies to suit a range of contexts |
| 1. Conduct interview | 1. A range of appropriate communication strategies are employed in ***interview situations*** 2. Records of interviews are made and maintained in accordance with organizational procedures 3. Effective questioning, listening and nonverbal communication techniques are used to ensure that required message is communicated |
| 1. Facilitate group discussion | * 1. Mechanisms which enhance ***effective group interaction*** is defined and implemented   2. Strategies which encourage all group members to participate are used routinely   3. Objectives and agenda for meetings and discussions are routinely set and followed   4. Relevant information is provided to group to facilitate outcomes   5. Evaluation of group communication strategies is undertaken to promote participation of all parties   6. Specific communication needs of individuals are identified and addressed |
| 1. Represent the organization | 1. When participating in internal or external forums, presentation is relevant, appropriately researched and presented in a manner to promote the organization 2. Presentation is clear and sequential and delivered within a predetermined time 3. Appropriate media is utilized to enhance presentation 4. Differences in views are respected 5. Written communication is consistent with organizational standards 6. Inquiries are responded in a manner consistent with 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** |
| Communication strategies may include but not limited to: | * Language switch * Comprehension check * Repetition * Asking confirmation * Paraphrase * Clarification request * Translation * Restructuring * Approximation * Generalization |
| 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 |
| 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:

* Effective communication
* Active listening
* Giving/receiving feedback
* Interpretation of information
* Role boundaries setting
* Negotiation
* Establishing empathy
* Openness and flexibility in communication
* Communication skills required to fulfill job roles as specified by the organization
* Writing communications strategy
* Applying key elements of communications strategy

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Communication process
* Dynamics of groups and different styles of group leadership
* Communication skills relevant to client groups
* Flexibility in communication
* Communication skills relevant to client groups
* 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/Demonstration with Oral Questioning 2. Written Examination |
| 1. Context of Assessment | Competency may be assessed individually in the actual workplace or through accredited institution |
| 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:** MED/OS/BT/BC/02/6/A

**UNIT DESCRIPTION**

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

**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** |
| Geometry may include but not limited to: | * Scale drawing * Triangles * Simple solid * Round * Square * Rectangular * Triangle * Sphere * Cylinder * Cube * Polygons * Cuboids |

**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:

* Applying Fundamental operations (addition, subtraction, division, multiplication)
* Using calculator
* Using different measuring tools

**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. Performed calculations with positive and negative numbers   2. Used numbers expressed as powers and roots in calculations   3. Simplified ratios and rates   4. Constructed graphs, charts or tables to represent ratios, rates and proportions   5. Calculate the volume of 3D shapes using relevant formulas   6. Calculated sides of right-angle triangles using Pythagoras’ theorem   7. Applied scales in calculation of actual distances   8. Planned routes by determining directions, distance calculation, speeds and time.   9. Identified types of angles in 2D and 3D shapes   10. Used angle properties in evaluating unknown angles   11. Applied properties of perpendicular and parallel lines in shapes construction.   12. Collected and organized appropriate statistical data   13. Collected and organized appropriate statistical data   14. Identified and used appropriate formulas for work related tasks   15. Identified and used function keys on a scientific calculator |
| 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. Demonstration with Oral Questioning   3. Written Examination |
| 1. Context of Assessment | Competency may be assessed individually in the actual workplace or  through accredited institution |
| 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:** MED/OS/BT/BC/03/6/A

**UNIT DESCRIPTION**

This unit covers the competencies required to effectively use digital devices such as smartphones, tablets, laptops and desktop PCs. It entails identifying and using digital devices such as smartphones, tablets, laptops and desktop PCs for purposes of communication, work performance and management at the work place.

**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*** are identified ***and control measures*** are applied in accordance with laws governing protection of ICT   3. Computer threats and crimes are detected.   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   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** |
| Appropriate computer software may include but not limited to: | * A collection of instructions or computer tools that enable the user to interact with a computer, its hardware, or perform tasks. |
| 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 |
| Data security and privacy may include but not limited to: | * Confidentiality of data * Cloud computing * Integrity -but-curious data surfing |
| Security and control measures may include but not limited to: | * Counter measures against cyber terrorism * Risk reduction * Cyber threat issues * Risk management * Pass-wording |
| Security threats may include but not limited to: | * Cyber terrorism * Hacking |
| Word processing concepts may include but not limited to: | * Using a special program to create, edit and print documents |
| Network configuration may include but not limited to: | * Organizing and maintaining information on the components of a computer network |

**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 | * 1. Tablets   2. Laptops and   3. Desktop PCs   4. Desktop computer   5. Lap top   6. Calculator   7. Internet   8. Smart phone   9. Operations Manuals |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Written Test   2. Demonstration   3. Practical assignment   4. Interview/Oral Questioning   5. Demonstration |
| 1. Context of Assessment | Competency may be assessed in an off and on the job setting |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# DEMONSTRATE UNDERSTANDING OF ENTREPRENEURSHIP

**UNIT CODE:** MED/OS/BT/BC/04/6/A

**UNIT DESCRPTION**

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

**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 but not limited to: | 1. Innovators 2. Imitators 3. Craft 4. Opportunistic 5. Speculators |
| 1. Principles of Entrepreneurship but not limited to: | 1. Visionary 2. Solution provider 3. Accountability 4. Growth and marketing 5. Resilient 6. Tenacious |
| 1. Characteristics of Entrepreneurs include but not limited to: | 1. Creative 2. Innovative 3. Planner 4. Risk taker 5. Networker 6. Confident 7. Flexible 8. Persistent 9. Patient 10. Independent 11. Future oriented 12. Goal oriented |
| 1. Requirements for entry into self-employment | 1. Technical skills 2. Management skills 3. Entrepreneurial skills 4. Resources 5. Infrastructure |
| 1. Internal motivation includes but not limited to: | 1. Interest 2. Passion 3. Freedom 4. Prestige |
| 1. Business environment includes but not limited to: | 1. External 2. Internal 3. Intermediate |
| 1. Forms of businesses includes but not limited to: | 1. Sole proprietorship 2. Partnership 3. Limited companies 4. Cooperatives |
| 1. Governing policies includes but not limited to: | 1. Increasing scope for finance 2. Promoting cooperation between entrepreneurs and private sector 3. Reducing regulatory burden on entrepreneurs 4. Developing IT tools for entrepreneurs |
| 1. External motivation includes but not limited to: | 1. Rewards 2. Punishment 3. Enabling environment 4. Government policies |
| 1. Entrepreneurial orientation includes but not limited to: | 1. Passion 2. Interest 3. Hobbies 4. Skills |
| 1. Innovative business strategies include but not limited to: | 1. New products 2. New methods of production 3. New markets 4. New sources of supplies 5. Change in industrialization |
| 1. Communication principles include but not limited to: | 1. Feed back 2. Attention 3. Clarity 4. Timeliness 5. Adequacy 6. Consistency 7. Informality |
| 1. Motivational theories include but not limited to: | 1. Marslows theory 2. McClelland theory 3. Fredrick Tylors theory |

**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:

* Assessing a range of alternative products and strategies
* Critically analyzing information, summarizing and making sense of previous and current market trends
* Identifying changing consumer preferences and demographics
* Thinking “outside the box”
* Ensuring quality consistency
* Reducing lead time to product/service delivery
* Management
* Using formal problem-solving procedures, e. g., root-cause analysis, six sigmas
* Communication
* Applying motivational principles, e. g., positive stroking, behavior modification
* Assessing range of alternatives rather than choosing the easiest option
* Achieving ownership and credibility for the enterprise vision
* Critically analyzing information, summarizing and making sense of previous and current market trends
* Developing solutions and practical strategies which are “outside the box”

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Entrepreneurial competencies
* Decision making
* Business communication
* Change management
* Coping with competition
* Risk taking
* 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
* Concepts of change management
* Relevant developments in other industries
* Regional/ County business expansion strategies
* Innovation in business

**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. Distinguished entrepreneurs and business persons correctly 2. Identified ways of becoming an entrepreneur appropriately 3. Explored factors affecting entrepreneurship development appropriately 4. Analysed importance of self-employment accurately 5. Identified requirements for entry into self-employment correctly 6. Identified sources of business ideas correctly 7. GeneratedBusiness ideas and opportunities correctly 8. Analysed business life cycle accurately 9. Identified legal aspects of business correctly 10. Assessed product demand accurately 11. Determined Internal and external motivation factors appropriately 12. Carried out communications effectively 13. Identified sources of business finance correctly 14. Determined Governing policy on small scale enterprise appropriately 15. Explored problems of starting and operating SSEs effectively 16. Developed Marketing, Organizational/Management, Production/Operation and Financial plans correctly 17. Prepared executive summary correctly 18. Determined business innovative strategies appropriately 19. Presented business plan effectively |
| 1. Resource Implications | The following resources should be provided:   1. Check list 2. Research tools (Questionnaire, interview guide, observation schedule) 3. Materials, tools, equipment and machines relevant |
| 1. Methods of Assessment | 1. Written tests 2. Observation 3. Oral questions 4. Third party report 5. Interviews 6. Case problems 7. Portfolio |
| 1. Context of Assessment | 1. Competency may be assessed in workplace or in a simulated workplace setting 2. Assessment shall be observed while tasks are being undertaken whether individually or in-group |
| 5. 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:** MED/OS/BT/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. Emotions are managed 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. 6. Self-esteem and a positive self-image are developed and maintained. 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 as per ***personal objectives*** 10. Critics are managed as per personal objectives |
| 1. Demonstrate interpersonal communication | 1. Listening and understanding is demonstrated as per communication policy 2. Writing to the needs of the audience is demonstrated as per communication policy 3. Speaking, reading and writing is demonstrated as per communication policy 4. Negotiation skills are demonstrated as per communication policy 5. Empathizing is demonstrated as per the communication policy 6. Numeracy is applied as per the communication policy 7. Internal and external customers’ needs are identified and interpreted as per the communication policy 8. Persuasion is demonstrated as per the communication policy 9. Communication networks are established as per the SOPs 10. Information is shared as per communication structure |
| 1. Demonstrate critical safe work habits | * 1. Stress is managed in accordance with workplace procedures.   2. Punctuality and time consciousness are 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 procedures.   6. Leisure time is recognized in line with organization policy.   7. Abstinence from ***drug and substance abuse*** is observed as per workplace policy.   8. Awareness of HIV and AIDS is demonstrated in line with workplace requirements.   9. Safety consciousness is demonstrated in the workplace based on organization safety policy.   10. ***Emerging issues*** are dealt with in accordance with organization policy. |
| 1. Lead a workplace team | 1. Performance expectations for the ***team*** are set 2. Duties and responsibilities are assigned in accordance with the organization policy. 3. Team parameters and ***relationships*** are identified according to set rules and regulations. 4. ***Forms of communication*** in a team are established according to office policy. 5. Communication is carried out as per workplace place policy and requirements of the job. 6. Team performance is supervised 7. ***Feedback*** on performance is collected and analyzed based on established team learning process 8. Conflicts are resolved between team members in line with organization rules and regulations. 9. ***Gender mainstreaming*** is undertaken in accordance with set regulations. 10. Human rights are adhered to in accordance with existing protocol. 11. Healthy relationships are developed and maintained for harmonious co-existence in line with workplace. |
| 1. Plan and organize work | 1. Task requirements are identified as per the workplace objectives 2. Task is interpreted in accordance with safety (OHS), environmental requirements and quality requirements 3. Work activity is organized with other involved personnel as per the SOPs 4. Resources are mobilized, allocated and utilized to meet project goals and deliverables. 5. Work activities are monitored and evaluated in line with organization procedures. 6. Job planning is documented in accordance with workplace requirements. 7. Planning and organizing of work activities is reviewed as per the workplace requirements 8. Time is managed achieve workplace set goals and objectives. |
| 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 availed based on job requirements.   3. Resources for training are mobilized and allocated based organizations skills needs.   4. Licensees and certifications relevant to job and career are obtained and renewed.   5. ***Personal growth*** is pursued towards improving the qualifications set for the profession.   6. Work priorities and commitments are managed based on requirement of the job and workplace policy.   7. Recognitions are sought as proof of career advancement in line with professional requirements. |
| 1. Demonstrate workplace learning | * 1. Own learning is managed as per workplace policy.   2. Learning opportunities are sought and allocated based on job requirement and in line with organization policy.   3. Contribution to the learning community at the workplace is carried out.   4. ***Range of media for learning*** are established as per the training need   5. Application of learning is demonstrated in both technical and non-technical aspects based on requirements of the job   6. Enthusiasm for ongoing learning is demonstrated   7. Time and effort are invested in learning new skills-based job requirements   8. Willingness to learn in different context is demonstrated based on available learning opportunities arising in the workplace.   9. Awareness of Occupational Health and Safety procedures are demonstrated in use of technology in the workplace.   10. Initiative is taken to create more effective and efficient processes and procedures in line with workplace policy.   11. New systems are developed and maintained in accordance with the requirements of the job.   12. Opportunities that are not obvious are identified and exploited in line with organization objectives.   13. Opportunities for performance improvement are identified proactively in area of work.   14. Awareness of personal role in workplace ***innovation*** is demonstrated. |
| 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.   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 workplace ethics | * 1. Policies and guidelines are observed as per the workplace requirements   2. Self-worth and profession are exercised in line with personal goals and organizational policies   3. Code of conduct is observed as per the workplace requirements   4. Personal and professional integrity is demonstrated as per the personal goals   5. Commitment to jurisdictional laws is demonstrated as per the workplace 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.

|  |  |
| --- | --- |
| **Range** | **Variable** |
| ***Drug and substance abuse*** include but not limited to: | Commonly abused   * Alcohol * Tobacco * Miraa * Over-the-counter drugs * Cocaine * Bhang * Glue |
| ***Feedback*** includes but not limited to: | * Verbal * Written * Informal * Formal |
| ***Relationships*** includes but not limited to: | * Man/Woman * Trainer/trainee * Employee/employer * Client/service provider * Husband/wife * Boy/girl * Parent/child * Sibling relationships |
| ***Forms of communication*** include but not limited to: | * Written * Visual * Verbal * Nonverbal * Formal and informal |
| ***Team*** includes but not limited to: | * Small work group * Staff in a section/department * Inter-agency group |
| ***Personal growth*** includes 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 | |
| ***Personal objectives*** include but not limited to: | * Long term * Short term * Broad * Specific |
| ***Trainings and career opportunities*** includes but not limited to | * Participation in training programs * Technical * Supervisory * Managerial * Continuing Education * Serving as Resource Persons in conferences and workshops |
| ***Resource*** include but not limited to: | * Human * Financial * Technology * Hardware * Software |
| ***Innovation*** include but not limited to: | * New ideas * Original ideas * Different ideas * Methods/procedures * Processes * New tools |
| ***Emerging issues*** include but not limited to: | * Terrorism * Social media * National cohesion * Open offices |
| ***Range of media for learning*** 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:

* Personal hygiene practices
* Intra and Interpersonal skills
* Communication skills
* Knowledge management
* Interpersonal skills
* Critical thinking skills
* Observation skills
* Organizing skills
* Negotiation skills
* Monitoring skills
* Evaluation skills
* Record keeping skills
* Problem solving skills
* Decision Making skills
* Resource utilization skills
* Resource mobilization skills

**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
* Personal hygiene practices
* Workplace communication
* Concept of time
* Time management
* Decision making
* Types of resources
* Work planning
* Resources and allocating resources
* Organizing work
* Monitoring and evaluation
* Record keeping
* Workplace problems and how to deal with them
* Negotiation
* Assertiveness
* Teamwork
* Gender mainstreaming
* HIV and AIDS
* Drug and substance abuse
* Leadership
* Safe work habits
* Professional growth and development
* Technology in the workplace
* Learning
* Creativity
* Innovation
* Emerging issues
  + Social media
  + Terrorism
  + National cohesion

**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 ethical performance |
| 1. Resource Implications | |  | | --- | | The following resources should be provided: |  * 1. Case studies/scenarios |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * Oral Interview * Observation * Third Party Reports * Written |
| 1. Context of Assessment | * 1. Competency may be assessed in workplace or in a simulated workplace setting   2. Assessment shall be observed while tasks are being undertaken whether individually or in-group |
| 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:** MED/OS/BT/BC/06/6/A

**UNIT DESCRIPTION**

This unit specifies the competencies required to follow procedures for environmental hazard control, follow procedures for environmental pollution control, comply with workplace sustainable resource use, evaluate current practices in relation to resource usage, develop and adhere to environmental protection principles/strategies/guidelines, analyze resource use, develop resource conservation plans and implement selected 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 | 1.1 ***Storage methods*** for environmentally hazardous materials are strictly followed according to environmental regulations and OSHS.  1.2 ***Disposal methods*** of hazardous wastes are followed at all times according to environmental regulations and OSHS.  1.3 ***PPE*** is used according to OSHS. |
| 1. Control environmental Pollution control | * 1. Environmental pollution ***control measures*** are compiled following standard protocol.   2. Procedures for solid waste management are observed according Environmental Management and Coordination Act 1999   3. Methods for minimizing ***noise pollution*** complied following environmental regulations. |
| 1. Demonstrate sustainable resource use | * 1. Methods for minimizing wastage are complied with.   2. Waste management procedures are employed following principles of 3Rs (Reduce, Reuse, Recycle)   3. Methods for economizing or reducing resource consumption are practiced. |
| 1. Evaluate current practices in relation to resource usage | * 1. Information on resource efficiency systems and procedures are collected and provided to the work group where appropriate.   2. Current resource usage is measured and recorded by members of the 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 | 5.1 Environmental legislations/conventions and local ordinances are identified according to the different environmental aspects/impact  5.2 Industrial standard/environmental practices are described according to the different environmental concerns |
| 1. Implement specific environmental programs | 6.1 Programs/Activities are identified according to organizations policies and guidelines.  6.2 Individual roles/responsibilities are determined and performed based on the activities identified.  6.3 Problems/constraints encountered are resolved in accordance with organizations’ policies and guidelines  6.4 Stakeholders are consulted based on company guidelines |
| 1. Monitor activities on Environmental protection/Programs | 7.1 Activities are periodically monitored and Evaluated according to the objectives of the environmental program  7.2 Feedback from stakeholders are gathered and considered in Proposing enhancements to the program based on consultations  7.3 Data gathered are analyzed based on Evaluation requirements  7.4 Recommendations are submitted based on the findings  7.5 Management support systems are set/established to sustain and enhance the program  7.6 Environmental incidents are monitored and reported to  concerned/proper authorities |
| 1. Analyze resource use | 8.1. All resource consuming processes are Identified  8.2. Quantity and nature of Resource consumed is determined  8.3. Resource flow is analyzed through different parts of the process.  8.4. Wastes are classified for possible source of resources. |
| 1. Develop resource Conservation plans | 9.1. Efficiency of use/conversion of resources is determined following 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** |
| ***PPE*** May include but are not limited to | 1.1 Mask  1.2 Gloves  1.3 Goggles  1.4 Safety hat  1.5 Overall  1.6 Hearing protector |
| ***Environmental pollution control measures*** may include but are not limited to: | 2.1 Methods for minimizing or stopping spread and ingestion of airborne particles  2.2 Methods for minimizing or stopping spread and ingestion of gases and fumes  2.4 Methods for minimizing or stopping spread and ingestion of liquid wastes |
| ***Wastes*** may include but are not limited to: | 3.1 Unnecessary waste  3.2 Necessary waste |
| ***Waste management Procedures*** may include but are not limited to: | 4.1 Sorting  4.2 Storing of items  4.2 Recycling of items  4.3 Disposal of items |
| ***Resources*** may include but are not limited to: | 5.1 Electric  5.2 Water  5.3 Fuel  5.4 Telecommunications  5.5 Supplies  5.6 Materials |
| ***Workplace environmental hazards*** may include but are not limited to: | 6.1Biological hazards  6.2 Chemical and dust hazards  6.3 Physical hazards |
| ***Organizational systems and procedures*** may include but are not limited to: | 7.1 Supply chain, procurement and purchasing  7.2 Quality assurance  7.3 Making recommendations and seeking approvals |
| ***Legislations/Conventions*** may include but are not limited to: | 8.1 EMCA 1999  8.2 Montreal Protocol  8.3 Kyoto Protocol |
| ***Environmental aspects/impacts*** may include but are not limited to: | 9.1 Air pollution  9.2 Water pollution  9.3 Noise pollution  9.4 Solid waste  9.5 Flood control  9.6 Deforestation/Denudation  9.7 Radiation/Nuclear /Radio Frequency/ Microwaves  9.8 Situation  9.9 Soil erosion (e.g. Quarrying, Mining, etc.)  9.10 Coral reef/marine life protection |
| ***Industrial standards / Environmental practices*** may include but are not limited to: | 10.1 ISO standards  10.2 Company environmental management systems  (EMS) |
| ***Periodic*** may include but are not limited to: | 11.1 hourly  11.2 daily  11.3 weekly  11.4 monthly  11.5 quarterly  11.6 yearly |
| ***Programs/Activities*** may include but are not limited to: | 12.1 Waste disposal (on-site and off-site)  12.2 Repair and maintenance of equipment  12.3 Treatment and disposal operations  12.4 Clean-up activities  12.5 Laboratory and analytical test  12.6 Monitoring and evaluation  12.7 Environmental advocacy programs |

**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:

* Following storage methods of environmentally hazardous materials
* Following disposal methods of hazardous wastes
* Using PPE
* Practicing OSHS
* Complying environmental pollution control
* Observing solid waste management
* Complying methods of minimizing noise Pollution
* Complying methods of minimizing wastage
* Employing waste management procedures
* Economizing resource consumption
* Listing of resources used
* Measuring current usage of resources
* Identifying and reporting workplace environmental hazards
* Conveying all environmental issues
* Following environmental regulations
* Identifying environmental regulations
* Assessing procedures for assessing compliance
* Collecting information on environmental and resource efficiency systems and procedures, and Providing information to the work group
* Measuring and recording current resource usage
* Analysing and recording current purchasing strategies.
* Analysing current work processes to access information and data and Assisting identifying areas for improvement
* Analysing resource flow
* Determining efficiency of use/conversion of resources
* Determining causes of low efficiency of use
* Developing plans for increasing the efficiency of resource use
* Checking resource use plans
* Complying to regulations/licensing requirements
* Determining benefit/cost of plans
* Ranking proposals based on benefit/cost compared to limited resources
* Checking proposals meet regulatory requirements
* Monitoring implementation
* Making adjustments to plan and implementation
* checking new resource usage

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Storage methods of environmentally hazardous materials
* Disposal methods of hazardous wastes
* Usage of PPE Environmental regulations
* OSHS
* Types of pollution
* Environmental pollution control measures
* Different solid wastes
* Solid waste management
* Different noise pollution
* Methods of minimizing noise pollution
* Methods of minimizing wstage
* Waste management procedures
* Economizing of resource consumption
* Principle of 3Rs
* Types of resources
* Techniques in measuring current usage of resources
* Calculating current usage of resources
* Types of workplace environmental hazards
* Environmental regulations
* Environmental regulations applying to the enterprise.
* Procedures for assessing compliance with environmental regulations.
* Collection of information on environmental and resource efficiency systems and procedures,
* Measurement and recording of current resource usage
* Analysis and recording of current purchasing strategies.
* Analysis current work processes to access information and data Analysis of data and information
* Identification of areas for improvement
* Resource consuming processes
* Determination of quantity and nature of resource consumed
* Analysis of resource flow of different parts of the resource flow process
* Use/conversion of resources
* Causes of low efficiency of use
* Increasing the efficiency of resource use
* Inspection of resource use plans
* Regulations/licensing requirements
* Determine benefit/cost for alternative resource sources
* Benefit/costs for different alternatives
* Components of proposals
* Criteria on ranking proposals
* Regulatory requirements
* Proposals for improving resource efficiency
* Implementation of resource efficiency plans
* Procedures in monitor implementation
* Adjustments of implementation plan
* Inspection of new resource usage

**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. Demonstration   2. Oral questioning   3. Written examination   4. Interview/Third Party Reports   5. Portfolio (citations/awards from GOs and NGOs, certificate of training – local and abroad)   6. Simulations and role-play |
| 1. Context of Assessment | Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment. |
| 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:** MED/OS/BT/BC/07/6/A

**UNIT DESCRIPTION**

This unit specifies the competencies required to lead the implementation of workplace’s safety and health program, 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 and/or its ***indicators*** of its presence, are identified  1.2 ***Evaluation and/or work environment*** measurements of OSH hazards/risk existing in the workplace is conducted by  Authorized personnel or agency  1.3 ***OSH issues and/or concerns*** raised by workers are  Gathered |
| 1. Identify and implement appropriate control measures | 2.1 Prevention ***and control measures***, including use of  s***afety gears / PPE (personal protective equipment)*** for specific hazards  identified and implemented  2.2 ***Appropriate risk controls*** based on result of OSH hazard evaluation is recommended.  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, procedures and policies/ guidelines | 3.1 Information to work team about company OSH program, procedures and policies/guidelines are provided  3.2 Implementation of OSH procedures and policies/ guidelines are participated  3.3 Team members are trained and advised on OSH standards and procedures  3.4 Procedures for maintaining ***OSH-related records*** are implemented |

**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 are not limited to: | 1.1. Physical hazards – impact, illumination, pressure, noise,  vibration, extreme temperature, radiation  1.2 Biological hazards- bacteria, viruses, plants, parasites, mites, molds, fungi, insects  1.3 Chemical hazards – dusts, fibers, mists, fumes, smoke,  gasses, vapors  1.4 Ergonomics  Psychological factors – over exertion/ excessive force,  awkward/static positions, fatigue, direct pressure,  varying metabolic cycles  Physiological factors – monotony, personal  relationship, work out cycle  1.6 Safety hazards (unsafe workplace condition) –  confined space, excavations, falling objects, gas  leaks, electrical, poor storage of materials and  waste, spillage, waste and debris  1.7 Unsafe workers’ act (Smoking in off-limited areas, Substance and alcohol abuse at work) |
| 1. ***Indicators may include*** but are not limited to: | 2.1 Increased of incidents of accidents, injuries  2.2 Increased occurrence of sickness or health complaints/ symptoms  2.3 Common complaints of workers related to OSH  2.4 High absenteeism for work-related reasons |
| 1. ***Evaluation and/or work environment measurements*** may include but are not limited to: | 3.1 Health Audit  3.2 Safety Audit  3.3 Work Safety and Health Evaluation  3.4 Work Environment Measurements of Physical and Chemical  Hazards |
| 1. ***OSH issues and/or concerns*** may include but are not limited to: | 4.1 Workers’ experience/observance on presence of work hazards  4.2 Unsafe/unhealthy administrative arrangements (prolonged work hours, no break time, constant overtime, scheduling of tasks)  4.3 Reasons for compliance/non-compliance to use of PPEs or other OSH procedures/policies/guidelines |
| 1. ***Prevention and control measures*** may include but are not limited to: | 5.1 Eliminate the hazard (i.e., get rid of the dangerous machine  5.2 Isolate the hazard (i.e. keep the machine in a closed room and operate it remotely; barricade an unsafe area off)  5.3 Substitute the hazard with a safer alternative (i.e., replace the machine with a safer one)  5.4 Use administrative controls to reduce the risk (i.e. give trainings on how to use equipment safely; OSH-related topics, issue warning signages, rotation/shifting work schedule)  5.5 Use engineering controls to reduce the risk (i.e. use safety guards to machine)  5.6 Use personal protective equipment  5.7 Safety, Health and Work Environment Evaluation  5.8 Periodic and/or special medical examinations of workers |
| 1. ***Safety gears /PPE (Personal Protective Equipment)*** may include but are not limited to: | 6.1 Arm/Hand guard, gloves  6.2 Eye protection (goggles, shield)  6.3 Hearing protection (earmuffs, ear plugs)  6.4 Hair Net/cap/bonnet  6.5 Hard hat  6.6 Face protection (mask, shield)  6.7 Apron/Gown/coverall/jump suit  6.8 Anti-static suits   * 1. High-visibility reflective vest |
| 1. ***Appropriate risk controls*** | Appropriate risk controls in order of impact are as follows:  7.1 Eliminate the hazard altogether (i.e., get rid of the dangerous machine)  7.2 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)  7.3 Substitute the hazard with a safer alternative (i.e., replace the machine with a safer one)  7.4 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)  7.5 Use engineering controls to reduce the risk (i.e., attach guards to the machine to protect users)  7.6 Use personal protective equipment (i.e., wear  gloves and goggles when using the machine) |
| 1. ***Contingency measures*** may include but are not limited to: | 8.1 Evacuation  8.2 Isolation  8.3 Decontamination  8.4 (Calling designed) emergency personnel |
| 1. ***Emergency procedures*** may include but are not limited to: | 9.1 Fire drill  9.2 Earthquake drill  9.3 Basic life support/CPR  9.4 First aid  9.5 Spillage control  9.6 Decontamination of chemical and toxic  9.7 Disaster preparedness/management  9.8 se of fire-extinguisher |
| 1. ***Incidents and emergencies*** may include but are not limited to: | 10.1 Chemical spills  10.2 Equipment/vehicle accidents  10.3 Explosion  10.4 Fire  10.5 Gas leak  10.6 Injury to personnel  10.7 Structural collapse  10.8 Toxic and/or flammable vapors emission. |
| 1. ***OSH-related Records*** may include but are not limited to: | 11.1 Medical/Health records  11.2 Incident/accident reports  11.3 Sickness notifications/sick leave application  11.4 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:

* Skills on preliminary identification of workplace hazards/risks
* Knowledge management
* Critical thinking skills
* Observation skills
* Coordinating skills
* Communication skills
* Interpersonal skills
* Troubleshooting skills
* Presentation skills
* Training skills

**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. Identifies hazards/risks in the workplace and/or its indicators 2. Requests for evaluation and/or work environment measurements of OSH hazards/risk in the workplace 3. Gathers OSH issues and/or concerns raised by workers 4. Identifies and implements prevention and control measures, including use of PPE (personal protective equipment) for specific hazards 5. Recommends appropriate risk controls based on result of OSH hazard evaluation and OSH issues gathered 6. Establish contingency measures, including emergency procedures in accordance with organization procedures 7. Provides information to work team about company OSH program, procedures and policies/guidelines 8. Participates in the implementation of OSH procedures and policies/guidelines 9. Trains and advises team members on OSH standards and procedures 10. Implements procedures for maintaining OSH-related records |
| 1. Resource Implications | The following resources should be provided:  2.1 Workplace or assessment location  2.2 OSH personal records  2.3 PPE  2.4 Health records |
| 1. Methods of Assessment | Competency may be assessed through:  3.1 Portfolio Assessment  3.2 Interview  3.3 Case Study/Situation  3.4 Observation/Demonstration and oral questioning |
| 1. Context of Assessment | Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment. |
| 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

# CONDUCT RESEARCH PROJECT

**UNIT CODE:** MED/OS/BT/CC/01/6/A

**UNIT DESCRIPTION**

This unit specifies the competencies required to conduct a research project. It involves identifying a research problem, formulating hypothesis or research questions, conducting literature review, developing research design and methodology, conducting data collection, conducting data analysis and presentation, preparing research proposal and preparing research report.

**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 a research problem | 1. Research problem identified as per requirements of industry 2. The scope of the study defined as per the research problem 3. A research title is formulated based on objective. |
| 1. Formulate hypothesis or research questions | 1. Research objectives are identified based on the title. 2. Research questions are established based on the objectives. 3. Hypothesis is formulated base on the research questions. |
| 1. Conduct literature review | 1. ***Sources of information*** are identified, assessed and analyzed based on research objectives. 2. Relevant information is read and cited based on area of study |
| 1. Develop research design and methodology | 1. The locality/site of the study identified based on the research objective. 2. Materials, methods and procedures identified based on the research problem. 3. A schedule of the study prepared based on timeframe of the study. 4. Research budget prepared based on the scope of the research 5. ***Types of research design*** are identified and selected based on the research objectives. 6. ***Sampling techniques*** are selected and established in line with the research design. 7. ***Data analysis techniques*** are selected and established research objective and research design. 8. Validity and reliability of research instruments is determined as per the research design. |
| 1. Prepare research proposal | 1. Parts of a research proposal identified 2. Research proposal formulated 3. General topic determined 4. Literature review Performed 5. Gap in the literature identified 6. Statement of the problem framed 7. Research hypotheses and or research questions determined 8. Method of investigation determined 9. Research design determined 10. Research budget is prepared 11. Sample Size and the characteristics of the Sample are determined 12. Data Collection and data analysis procedures are determined |
| 1. Conduct data collection | * 1. Data collection tools identified based on the research design   2. ***Sources of data*** are identified and assessed based on the research objective.   3. ***Methods o data collection*** are identified, assessed and analyzed based on the research design.   4. Data is collected in line with research objectives. |
| 1. Conduct data analysis and presentation | * 1. Data is analyzed and interpreted in line with research objectives.   2. Data processed and presented as per relevant methodology |
| 1. Prepare research report | 8.1 Research report format identified as per relevant standards  8.2 Research report prepared as per standards   * 1. Data collected is analyzed as per SOPs   2. Research findings are determined as per workplace procedures   3. Research findings are presented as per SOPs   4. Research conclusions are made as per analyzed report.   5. Research recommendations are carried out based on the result |

**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.

|  |  |
| --- | --- |
| Variables | Range |
| 1. Sources of information may include but are not limited to: | * Primary * Secondary |
| 1. Types of research design may include but are not limited to: | * Descriptive * Experimental * Case study * Correlational |
| 1. Sampling techniques may include but are not limited to: | * Probability * Non-probability |
| 1. Data analysis techniques may include but are not limited to: | * Hypothesis test |
| 1. Sources of data may include but are not limited to: | * Primary * Secondary |
| 1. Methods of data collection may include but are not limited to: | * Questionnaire * Interviewing * Observation |

**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:

* Organizing skills
* Analytical skills
* Negotiation skills
* Interpersonal skills
* Communication skills
* Evaluation skills
* Problem solving
* Critical thinking
* Presentation skills

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Research methods
* Technical report writing
* Communication skills
* Presentation skills

**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 Research problem as per requirements of industry 2. Defined the scope of the study as per the research problem 3. Formulated a research title-based objective. 4. Identified Research objectives based on the title. 5. Established Research questions based on the objectives. 6. Identified Sources of information based on research objectives. 7. Reviewed and cited Relevant information is based on area of study 8. Identified the locality/site of the study based on the research objective. 9. Identified Materials, methods and procedures based on the research problem. 10. Prepared a schedule of the study based on time frame of the study. 11. Prepared Research budget based on the scope of the research 12. Identified and selected Types of research design are based on the research objectives. 13. Data analysis techniques are selected and established research objective and research design. 14. Determined Validity and reliability of research instruments is as per the research design. 15. Developed a research proposal 16. Determined research design 17. Determined Data Collection Methods and data analysis Procedures 18. Identified Data collection tools based on the research design 19. Collected Data is in line with research objectives. 20. Analyzed and interpreted Data is in line with research objectives. 21. Processed and presented Data as per relevant methodology 22. Identified Research report format as per relevant standards 23. Prepared Research report as per standards 24. Determined and presented Research findings as per workplace procedures |
| 1. Resource implications for competence certification | The following resources must be provided:   * 1. Access to relevant workplace where assessment can take place   2. Appropriately simulated environment where assessment can take place   3. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Written tests   2. Third party reports   3. Oral questioning   4. Interview   5. Observation |
| 1. Context of Assessment | Assessment could be conducted:   1. On-the-job 2. Off-the–job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with related units in the sector |

APPLY MOLECULAR BIOLOGY

**UNIT CODE:** MED/OS/BT/CC/02/6/A

**UNIT DESCRIPTION**

This unit specifies the competencies required to apply molecular biology. It involves understanding DNA structure, understanding gene function and chemistry, understanding molecular markers, and utilizing molecular markers.

**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. Understand DNA structure | * 1. DNA structure is identified as per the organism   2. DNA structure is interpreted as per its functions   3. DNA structure is identified for its protein synthesis as per the organism |
| 1. Understand gene function and chemistry | * 1. DNA replication is determined as per type of protein   2. DNA transcription is determined as per type of RNA   3. DNA translation is determined as per type of protein |
| 1. Understand molecular markers | * 1. Type of **molecular marker** is identified as per its type   2. Type of molecular marker is selected as per its function   3. Molecular marker properties are determined as per its codes |
| 1. Utilization of molecular markers | * 1. Molecular markers are selected for diagnostic   2. Molecular markers are selected for diversity   3. Molecular markers are selected mapping |

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Molecular markers may include but not limited to: | * RAPDs * SSRs * AFLPs * RFLPs * SCARs |

**REQUIRED KNOWLEDGE AND SKILLS**

The individual needs to demonstrate knowledge of:

**SKILLS**

The individual needs to demonstrate the following skills

* Communication
* Information technology
* Synthesis and evaluation
* Decision making
* Management
* Leadership

**Knowledge**

* Biomolecules
* Biochemistry
* Cell biology

**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:  Demonstrates;   1. Understanding of DNA structure 2. Understanding of gene function and chemistry 3. Understanding of molecular markers 4. Ability to utilize molecular markers |
| 1. Resource Implications for competence certification | The following resources must be provided:   * 1. Access to relevant workplace where assessment can take place   2. Appropriately simulated environment where assessment can take place   3. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency may be accessed through:   * 1. Written tests   2. Oral questioning   3. Third party reports   4. Case studies |
| 1. Context of Assessment | Competency may be assessed:   1. On the job 2. Off the job 3. In work placement (attachment)   Off the job assessment must be undertaken in a closely simulated workplace environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry subsector, workplace and job roles is recommended. |

APPLY BIOMETRICS

**UNIT CODE:** MED/OS/BT/CC/03/6/A

**UNIT DESCRIPTION**

This unit specifies the competencies required to apply biometrics. It involves Understanding basic statistics, understanding basic statistical models, understanding how to interpret biostatistics data and how to infer biostatistics data.

**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. Understand basic statistics | * 1. Qualitative and quantitative variables are differentiated as per the type of data   2. Range of measurement is determined as per the data sample   3. Mean of measurement are calculated as per the data set   4. Median of data set sampled is calculated   5. Mode is identified as per the data set sampled   6. Standard deviation is calculated as per the data set sampled   7. Variance is calculated as per the data set sample   8. Hypothesis is tested |
| 1. Understand basic statistical models | * 1. T-test is calculated as per the data set sampled   2. Complete randomized design model of the experimental are determined as per experimental unit   3. Randomized complete block design model of the experimental are determined as per experimental units   4. Parametric and non-parametric models of the experiment are determined as per experimental units identified |
| 1. Interpret biostatistics data | * 1. Probability is tested as per the objectives of the experiment   2. The relationships between the dependent and independent variables of the experimental units are determined as per data set sampled   3. Linear correlation effects are determined as per the data set of the experimental units   4. Linear regression analyses of the data set sampled are determined as per the experimental units |
| 1. Understanding how to infer biostatistics data. | * 1. Confidence intervals of the experimental data are determined as per the data set collected   2. ***Hypotheses*** tested are inferred as per the experimental objectives   3. Coefficient of variation (CV) are inferred as per the experimental objectives   4. Conclusions are drawn as per experimental objectives |

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Hypotheses may include but are not limited to: | * Null hypothesis * Alternate hypothesis |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

**Knowledge**

* Basic mathematics
* Sampling methods
* ICT

**SKILLS**

The individual needs to demonstrate the following skills:

* Communication
* Data analysis
* Data synthesis and evaluation
* Data interpretation
* Decision making
* Management
* Leadership

**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:  Demonstrates;   1. Understanding of computing sample mean median range, mode standard deviation 2. Computation of population mean and sample standard deviation 3. Demonstrates the understanding of null hypothesis and alternate hypothesis 4. Demonstrates understanding of testing procedures of hypothesis 5. Ability to use tables , graphs, bar-charts, pie charts to summarize data and data results |
| 1. Resource Implications for competence certification | The following resources must be provided:   * 1. Access to relevant workplace where assessment can take place   2. Appropriately simulated environment where assessment can take place   3. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency may be accessed through:   * 1. Written tests   2. Oral questioning   3. Third party reports   4. Case studies |
| 1. Context of Assessment | Competency may be assessed:   1. On the job 2. Off the job 3. In work placement (attachment)   Off the job assessment must be undertaken in a closely simulated workplace environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry subsector, workplace and job roles is recommended. |

# APPLY CELL BIOLOGY & HISTOLOGY

**UNIT CODE:** MED/OS/BT/CC/04/6/A

**UNIT DESCRIPTION**

This unit specifies the competencies required apply cell biology and histology. It involves identifying cell structure and function, demonstrating the knowledge of cell and cell division, identifying histological and cytological methods and demonstrating knowledge of types of tissues and their location

**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 cell structure and function | 1. Relevant cell structures and physiological terminology***.*** 2. Relevant cell and physiological terminology applied to daily tasks as per the workplace procedures |
| 1. Demonstrate the knowledge of cell and cell division | 1. Cell types identified as per the workplace procedures 2. Components of a cell identified as per the workplace procedures 3. Processes of cell division outlined as per the SOP 4. The composition of cytoplasm described as per the workplace procedures |
| 1. Identify histological and cytological methods | 1. Direct observation performed based on workplace procedures 2. Histochemical methods identified based on the material available 3. Chemical methods identified based on the material available 4. Physical methods identified based on the material available 5. ***Staining methods*** identified as per workplace procedures 6. Immunohistochemical methods identified based on the material available 7. X-ray diffraction performed as per the workplace procedures |
| 1. Demonstrate knowledge of types of tissues and their location | 1. ***Tissue location*** outlined as per the workplace procedures 2. Embryonic tissues identified as per the tissue location 3. Types of tissues identified as per the tissue location |

**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.

|  |  |
| --- | --- |
| Variables | Range |
| 1. Staining methods may include but are not limited to: | * Hematoxylin and eosin * Uranyl acetate and lead citrate |
| 1. Tissue location may include but are not limited to: | * Epithelial * Connective * Adipose * Bone * Nerve and muscle |

**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:

* Organizing skills
* Analytical skills
* Negotiation skills
* Interpersonal skills
* Communication skills
* Evaluation skills
* Problem solving
* Critical thinking

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Basic cell structure
* Physiological terminologies
* Scope of histology and cytology

**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 relevant cell and physiological terminology   2. Applied relevant cell and physiological terminology to daily tasks as per the workplace procedures   3. Identified cell types as per the workplace procedures   4. Identified components of a cell as per the workplace procedures   5. Outlined processes of cell division as per the SOP   6. Described the composition of cytoplasm as per the workplace procedures   7. Performed direct observation based on workplace procedures   8. Identified histochemical methods based on the material available   9. Identified chemical methods based on the material available   10. Identified physical methods based on the material available   11. Identified Staining methods as per workplace procedures   12. Identified immunohistochemical methods based on the material available   13. Performed X-ray diffraction as per the workplace procedures   14. Outlined tissue location as per the workplace procedures   15. Identified embryonic tissues as per the tissue location   16. Classified tissues as per the tissue location |
| 1. Resource Implications for competence certification | The following resources must be provided:   * 1. Access to relevant workplace where assessment can take place   2. Appropriately simulated environment where assessment can take place   3. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Written tests   2. Third party reports   3. Oral questioning   4. Interview   5. Observation |
| 1. Context of Assessment | Assessment could be conducted:   1. On-the-job 2. Off-the–job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with related units in the sector |

# CORE UNITS OF COMPETENCY

# CONDUCT BIOTECHNOLOGY RESEARCH

**UNIT CODE:** MED/OS/BT/CR/01/6/A

**UNIT DESCRIPTION**

This unit specifies the competencies required to conduct research using biotechnology techniques. It involves planning and conducting tests and experiments, handling laboratory chemicals, operating and maintain computer and laboratory equipment, processing, interpreting, and recording research data, analyzing specific substances and monitoring quality control in research.

**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. Plan and conduct tests and experiments | * 1. Planning of all the activities is carried out according to workplace procedures   2. Personal protection equipment and apparel(***PPEs***) are identified gathered and donned based on experimental requirements   3. Occupational safety and health procedures are adhered to according to work place procedures.   4. Environmental protection measures are observed according to environmental protection regulations and work place procedures   5. Experimental setup is design as per experimental objective   6. Variables are manipulated as per experiments requirements   7. The effect of dependable variable is measured as per user requirements   8. Non-experimental factors are identified and controlled as per researcher needs   9. Data is collected as per experimental requirement |
| 1. Handle laboratory chemicals | * 1. PPEs are identified based on standard safety requirements   2. Laboratory chemicals are identified, classified and stored based on standard laboratory procedures and guidelines   3. Laboratory chemicals are retrieved and used as per experimental requirements   4. Used and expired laboratory chemicals are disposed according to manufacturer’s guidelines, workplace procedures and legislation set standards |
| 1. Operate and maintain computer and laboratory equipment | * 1. Pre-use and after-use checks are performed as per workplace and manufacturer procedures   2. Identify faulty or unsafe components and equipment as per the equipment manual and workplace procedures   3. Basic faults are troubleshot or need reported to the major maintenance and/or repairs as per equipment manual and work place procedures   4. Maintenance schedules are planned in accordance with standard operational procedures on the equipment manual   5. Maintenance procedures, records and safety requirements are identified as per work place procedure   6. Instruments and equipment are cleaned using recommended cleaning agents and techniques as per equipment manual and workplace procedures.   7. Instruments and equipment are stored in accordance with workplace and/or manufacturer requirements   8. Instruments and equipment are operated in accordance with workplace and/or manufacturer procedures   9. Personal protection equipment and apparel (***PPEs***) are identified gathered and donned based on experimental requirements   10. Occupational safety and health procedures are adhered to according to work place procedures.   11. Environmental protection measures are observed according to environmental protection regulations and work place procedures |
| 1. Process, interpret, and record research data | * 1. Data is retrieved and processed as per experimental objective   2. The quality of recorded data is verified as per workplace procedures   3. Errors in data are rectified as per workplace procedures   4. Statistical values for given data are calculated as per workplace procedures.   5. Data is interpreted as per experimental objectives and Standard Evaluation Systems (**SES**)   6. Workplace records are filed and stored as per workplace procedures |
| 1. Analyze specific substances | * 1. Scope, criteria and method for analysis are determined and verified as per organizational policy   2. Substances are analyzed according to established criteria.   3. Substance analysis result is documented in an appropriate format according to workplace requirements.   4. Personal protection equipment and apparel(***PPEs***) are identified gathered and donned based on experimental requirements   5. Occupational safety and health procedures are adhered to according to work place procedures.   6. ***Environmental protection measures*** are observed according to environmental protection regulations and work place procedures |
| 1. Monitor quality control in research | * 1. Quality standards and procedures are interpreted and applied in accordance with standard operating procedures.   2. Quality of research is monitored and reported as per the workplace procedures   3. Quality of all received, in-work and finished materials and products is monitored as per standard operating procedures   4. Designated process improvement tools are used to identify non conformities as per the experimental objectives and SES   5. Designated analytical tools are used to evaluate principal causes of process variation in consultation with the team or other subject experts as per the work place policy |

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Personal protective equipment (PPE) may include but not limited to: | * + Masks   + Gloves   + Safety hat   + Overall coats   + Gumboots   + Fume-cupboards   + Lamina flow bench   + Body showers |
| 1. Environmental protection measures may include but not limited to: | * + Methods of minimizing or stopping spread and ingestion of airborne particles   + Methods of minimizing or stopping spread and ingestion of gases and fumes   + Methods of minimizing or stopping spread and ingestion of liquids wastes   + Methods of minimizing or stopping spread noxious organisms |
| 1. Standard Evaluating Systems (SES) may include but not limited to: | * + Number of plate counts   + Culture and sensitivity tests   + Titer volumes   + Lethal doses |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

The individual needs to demonstrate knowledge of:

**Knowledge**

* Experimental methods
* Sampling methods
* Data collection
* Biostatistics
* Methods of data analysis
* Quality control
* Types of Laboratory
* Types of laboratory chemicals
* Types of laboratory equipment, items and hardware
* Information communication technology
* Equipment maintenance

**SKILLS**

The individual needs to demonstrate the following skills

* Communication
* Data Analysis
* Data Synthesis and evaluation
* Research methods
* Decision making
* Management
* Leadership
* Troubleshooting

**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. Planned and conducted tests and experiments 2. Gathered, processed, recorded and interpreted research data correctly 3. Operated and maintained computer and laboratory equipment’s 4. Analyzed specific substances 5. Monitored quality control in research works 6. Demonstrated understanding of biostatistics 7. Demonstrated understanding of research methods |
| 1. Resource Implications for competence certification | The following resources must be provided:   * 1. Access to relevant workplace where assessment can take place   2. Appropriately simulated environment where assessment can take place   3. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency may be accessed through:   * 1. Written tests   2. Oral questioning   3. Third party reports   4. Case studies |
| 1. Context of Assessment | Competency may be assessed:   1. On the job 2. Off the job 3. In work placement (attachment)   Off the job assessment must be undertaken in a closely simulated workplace environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry subsector, workplace and job roles is recommended. |

MANAGE MEDIA PREPARATION

**UNIT CODE:** MED/OS/BT/CR/02/6/A

**UNIT DESCRIPTION**

This unit specifies the competencies required to manage media preparation. It involves preparing of stock solutions, maintaining stock solution, preparing media, storing of media and maintaining media and equipment.

**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. Prepare stock solutions | * 1. Personal protection equipment and apparel(***PPEs***) are identified gathered and donned based on experimental requirements   2. Stock solution constituents are assembled as per the test and experiment   3. Stock constituents are weighed and diluted as per the test and experiment   4. Stock solutions are labeled as per the date of preparation   5. Stock solution is sterilized as per the nature of stock   6. Stock solution is stored as per standards operating procedures |
| 1. Maintain stock solution | * 1. Period of stock solution preservation is determined as per the nature of work being done   2. Method of preservation is chosen as per ***stock solution ingredients***   3. ***Type of stock solution***  is determined as per needs |
| 1. Prepare media | * 1. Equipment for media production are obtained as per type of media culture to be produced   2. Media ingredients are obtained as per type of media culture to be produced   3. Media ingredients are weighed as per planned tests to conduct   4. Media ingredients are mixed as per production specifications   5. Media is sterilized as per production temperature   6. Working area is cleaned and sterilized as per work place procedures   7. Media PH is adjusted as per the test   8. Media is dispensed into vessels for sterilization as per standard sterilization protocols |
| 1. storage of media | * 1. Media is labeled to allow tracking in subsequent use processes   2. Batch media is dated to ensure correct batch rotation   3. Media is labeled to allow for selection,   4. Areas of the culture vessel required for examination of colony growth are avoided as per work place policy   5. Records of batches of media are maintained as per work place policy   6. Media is stored and incubated as per SOPs   7. Control plates are incubated as a sterility check   8. Media is stored to maximize shelf life and minimize contamination |
| 1. Maintain media and equipment | * 1. Sterilizer is loaded as per maximum permitted loads and appropriate positioning of materials as per equipment operational manual and Standard Operating procedures (***SOPs***)   2. Sterilization indicator is correctly placed with the load to monitor sterilization process as per work place procedures and environmental protection regulations   3. Sterilization cycle is operated in accordance with manufacturer requirements and type of media ingredients   4. Media is cooled as per the temperature specified in the media formulation procedures and as per work place procedures |

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Type of microorganismsmay include but not limited to: | * Bacteria * Viruses * Algae * Protozoa * Yeasts * Mould |
| 1. Type of stock culture may include but not limited to: | * Working stock * Primary stock |
| 1. Standard operating procedures (SOPs) may include but not limited to: | * Load the media not to the brim of the media vessel * Check the water level of the sterilizer * Loosely cap the media vessel |
| 1. Personal protective equipment (PPE) may include but not limited to: | * + Masks   + Gloves   + Safety hat   + Overall coats   + Gumboots   + Fume-cupboards   + Lamina flow bench   + Body showers |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

The individual needs to demonstrate knowledge of:

**Knowledge**

* Types of stock solutions
* Types of media cultures
* Microbiology
* Types of sterilizations
* Types of sterilization equipment
* Types of sterilization indicators
* Types of culture vessels
* Storage requirements of different cultures
* Rules and guidelines in Biotechnology laboratory

**SKILLS**

The individual needs to demonstrate the following skills:

* Communication
* Methods of culture preparation
* Methods of maintaining stock cultures
* Methods of sterilization
* Methods of media culture disposal
* Data Analysis
* Synthesis and evaluation
* Decision making
* Management
* Leadership

**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. Planned for culture preparation 2. Produced media culture 3. Maintained culture stock 4. Monitored storage of media 5. Managed disposal of media culture 6. Sterilized media culture equipment 7. Demonstrated understanding of microbiology |
| 1. Resource Implications | The following resources must be provided:   * 1. Access to relevant workplace where assessment can take place   2. Appropriately simulated environment where assessment can take place   3. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency may be accessed through:   * 1. Written tests   2. Oral questioning   3. Third party reports   4. Observations   5. Case studies |
| 1. Context of Assessment | Competency may be assessed:   1. On the job 2. Off the job 3. In work placement (attachment)   (Off the job assessment must be undertaken in a closely simulated workplace environment) |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry subsector, workplace and job roles is recommended. |

# MANAGE INDUSTRIAL WASTE

**UNIT CODE:** MED/OS/BT/CR/03/6/A

**UNIT DESCRIPTION**

This unit specifies the competencies required to manage industrial waste. It involves carrying out industrial waste treatment, managing biodegradable materials, controlling industrial pollution and utilizing industrial waste.

**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. Carry out industrial waste treatment | * 1. Industrial waste is sorted as per their nature and environmental pollution effect   2. Type of industrial waste to be treated is determined as per industry processes   3. Legislations relating to industrial waste treatment are obtained and applied as per government policy   4. Waste management systems are set up as per industrial waste legislation   5. Personal protection equipment and apparel (***PPEs***) are identified gathered and donned based on industrial waste   6. Occupational safety and health procedures are adhered to according to work place procedures.   7. Environmental protection measures are observed according to environmental protection regulations and work place procedures |
| 1. Manage biodegradable materials | * 1. Personal protection equipment and apparel (***PPEs***) are identified gathered and donned based on work place procedures   2. Occupational safety and health procedures are adhered to according to work place procedures.   3. Biodegradable materials are obtained as per work place procedures   4. Biodegradation rate is determined as per type of waste   5. Factors that affect biodegradation rates during product testing are identified as per standard testing methods. |
| 1. Control industrial pollution | * 1. The nature of pollution is determined as per set standard and government policies   2. Method of industrial pollution control is identified as per the nature of pollution   3. Tools, equipment and materials for pollution control are obtained as per work place procedures |
| 1. Utilize industrial waste | * 1. Nature of industrial waste is determined as per legal regulations   2. Industrial waste is analyzed as per user needs   3. Physical biochemical and microbial properties are identified as per nature of industrial waste   4. Industrial waste byproducts are produced as per user needs |

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Personal protective equipment (PPE) may include but not limited to: | * + Mask   + Cloves   + Safety hat   + Overall   + Gumboots   + Fume-cupboards   + Lamina flow bench   + Body showers |
| 1. Waste may include but not limited to: | * + Biodegradable   + Non-biodegradable |

**REQUIRED KNOWLEDGE AND SKILLS**

The individual needs to demonstrate knowledge of:

**Knowledge**

* ICT
* Types of wastes
* Types of pollution
* Waste management systems
* Environmental biology and health
* Waste disposal
* Waste utilization

**SKILLS**

The individual needs to demonstrate the following skills:

* Communication
* Handling industrial wastes
* Waste treatment
* Waste utilization
* Data analysis
* Data Synthesis and evaluation
* Decision making
* Management
* Leadership

**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. Carried out industrial waste treatment 2. Managed biodegradable materials 3. Identified and used PPEs correctly and appropriately 4. Controlled industrial pollution 5. Utilized industrial wastes 6. Demonstrated understanding of different types of wastes 7. Demonstrated understanding of environmental biology and health 8. Demonstrated understanding of waste treatment |
| 1. Resource Implications | The following resources must be provided:   * 1. Access to relevant workplace where assessment can take place   2. Appropriately simulated environment where assessment can take place   3. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency may be accessed through:   * 1. Written tests   2. Oral questioning   3. Third party reports   4. Case studies |
| 1. Context of Assessment | Competency may be assessed:   1. On the job 2. Off the job 3. In work placement (attachment)   Off the job assessment must be undertaken in a closely simulated workplace environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry subsector, workplace and job roles is recommended. |

# MANAGE LIVESTOCK PRODUCTION

**UNIT CODE:** MED/OS/BT/CR/04/6/A

**UNIT DESCRIPTION**

This unit specifies the competencies required in livestock production. It involves carrying out genetic improvement for productivity, producing enriched animal feeds, preventing and control animal diseases and erforming biotechnological diagnosis of animal diseases

**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. Carry out genetic improvement for productivity | * 1. The individual animal information is recorded as per Information Network for Animal Productivity and Health (INAPH) guidelines   2. Best animals are selected as per INAPH analyzed information   3. Selected animals are bred based on biotechnological tools and techniques |
| 1. Produce enriched animal feeds | * 1. Animal nutritional requirements are determined as per the animal nutritional requirements   2. Ingredients for production of animal feeds are obtained as per nutrition requirement   3. Animal ingredients are weighed as per work place procedures   4. Animal feeds are formulated as per animal nutritional needs   5. Animal ***feed production technologies*** are identified and applied based on animal nutritional requirements |
| 1. Prevent and control animal diseases | * 1. Sick animals are isolated for disease sample collection as per standards operating procedures and work place ethics   2. Disease identification samples are collected and analyzed according to ***SOPs***   3. Animal diseases are determined as per biotechnological techniques   4. Animal vaccines are procured and administered according to standard guidelines   5. Animal disease records are managed as per standard procedures   6. Disease outbreak is notified according to legal requirements |
| 1. Perform biotechnological diagnosis of animal diseases | * 1. Sick animals are identified as per standard operating procedures and personal protective elements   2. Sick animals are isolated for disease sample collection as per standards operating procedures and work place ethics   3. Samples are processed as per standards operating procedures and work place ethics   4. Diseases causing organisms are identified based on standard operating procedures and standard evaluation systems based on ***biotechnological methods*** |

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Feed production technologies may include but not limited to: | * Hydroponics * Silage technology * Tissue culture * Bio fortification |
| 1. Standard operating procedures (SOPs) may include but not limited to: | * + Use stethoscope, thermometer, weighing band, ropes for restraining.   + Check for vital parameters e.g. temperatures, respiratory rate, heart rate/Pulse rates. |
| 1. Personal protective equipment (PPE) may include but not limited to: | * + Mask   + Cloves   + Safety hat   + Overall coats   + Gumboots |
| 1. Biotechnological methods may include but not limited to: | * Serological tests * molecular tests * cultures |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

The individual needs to demonstrate knowledge of:

**Knowledge**

Communication

* Animal diseases
* Genetics
* Animal nutrition and formulations
* Animal disease control and prevention
* Molecular biology
* Development of animal vaccines

**SKILLS**

The individual needs to demonstrate the following skills:

* Communication
* Animal handling
* Disease diagnostic methods
* Identification of sick animals
* Disease prevention and control
* Synthesis and evaluation
* Decision making
* Management
* Leadership
* Analytical

**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. Carried out genetic improvement for productivity 2. Identified and used PPEs correctly and appropriately 3. Produced enriched animal feeds 4. Prevented and controlled animal diseases 5. Performed biotechnological diagnostics of animals’ diseases. 6. Demonstrated understanding of genetic engineering 7. Demonstrated understanding of production of recombinant vaccines |
| 1. Resource Implications for competence certification | The following resources must be provided:   * 1. Access to relevant workplace where assessment can take place   2. Appropriately simulated environment where assessment can take place   3. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency may be accessed through:   * 1. Written tests   2. Oral questioning   3. Third party reports   4. Case studies |
| 1. Context of Assessment | Competency may be assessed:   1. On the job 2. Off the job 3. In work placement (attachment)   Off the job assessment must be undertaken in a closely simulated workplace environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry subsector, workplace and job roles is recommended. |

# MANAGE PLANT PRODUCTION

**UNIT CODE:** MED/OS/BT/CR/05/6/A

**UNIT DESCRIPTION**

This unit specifies the competencies required to manage plant production. It involves pplying biotechnological techniques, managing biotic constraints, abiotic constraints and improving quality traits.

**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. Application of biotechnological techniques | * 1. Genetic profiling of Plant germplasm is carried out as per trait of interest   2. Plant germplasm are selected as per trait of interest   3. Plant germplasm are bred as per trait needs   4. True breeding progeny are selected as per ***biotechnology techniques***   5. Tissue culture approaches in crop husbandry |
| 1. Manage biotic constraints | * 1. Plant germplasm is identified as per trait of interest   2. Plant germplasm are selected as per trait of interest   3. Plant ***germplasm*** are bred as per trait needs   4. True breeding progeny are selected as per resistance to biotic stress using biotechnology techniques   5. Advanced selections are evaluated for biotic stress using biotechnology techniques |
| 1. Manage abiotic constraints | * 1. Plant germplasm is identified as per trait of interest   2. Plant germplasm are selected as per trait of interest   3. True breeding progeny are selected as per resistant tolerance to abiotic stress using biotechnology techniques   4. Advanced selections are evaluated for abiotic stress using biotechnology techniques |
| 1. Improve quality traits | * 1. Plant germplasm is identified as per trait of interest   2. Plant germplasm are selected as per trait of interest   3. True breeding progeny are selected as per quality traits using biotechnology techniques   4. Selected progeny are evaluated for quality traits using biotechnology techniques |

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Biotechnology techniquesmay include but not limited to: | * Recombinant DNA technology * Plant tissue culture and genetic * molecular markers. |
| 1. Germplasm may include but not limited to: | * Seeds * plant cuttings * plant tissues * clones * DNA library |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

The individual needs to demonstrate knowledge of:

**Knowledge**

* Communication
* Pest and diseases
* Environmental factors
* Plant breeding
* Plant selection methods
* Molecular biology
* Biostatistics
* Plant transformation
* Cloning
* Plant tissue culture
* ICT

**SKILLS**

The individual needs to demonstrate the following skills

* Data Analysis
* Data Synthesis and evaluation
* Molecular techniques
* Tissue culture techniques
* Decision making
* Management
* Leadership
* Analytical

**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:  Demonstrates;   * 1. Ability to carry out plant genetic improvement for increased productivity   2. Understand quality traits selection methods   3. Ability to control biotic constraints   4. Ability to control abiotic constraints   5. Ability to improve quality traits   6. Understanding of methods of crop genetic improvement   7. Understanding of methods of biotic constraints control   8. Understanding of methods of abiotic constraints control   9. Understanding of molecular techniques   10. Understanding of invitro culture techniques |
| 1. Resource Implications | The following resources must be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place 3. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency may be accessed through:   * 1. Written tests   2. Oral questioning   3. Third party reports   4. Case studies |
| 1. Context of Assessment | Competency may be assessed:   1. On the job 2. Off the job 3. In work placement (attachment)   Off the job assessment must be undertaken in a closely simulated workplace environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry subsector, workplace and job roles is recommended. |

# MANAGE FOOD PROCESSING

**UNIT CODE:** MED/OS/BT/CR/06/6/A

**UNIT DESCRIPTION**

This unit specifies the competencies required to manage food processing. It involves producing quality foods, producing microbial enzymes, carrying out food tests, carrying out food tests and preserving processed foods

**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. Produce quality processed foods | * 1. Personal protection equipment and apparel(***PPEs***) are identified gathered and donned based on production requirements   2. Quality food materials are obtained as per standard operating requirements and work place requirements   3. Cultures are identified as per food requirements   4. Machine components and related attachments are fitted and adjusted as per standard operating requirements and machine manuals.   5. Operating parameters are entered as per safety and production requirements   6. Quality improvement processes are started and operated according to workplace procedures and standard operating procedures   7. Equipment is monitored to identify variation in operating conditions   8. The process is monitored as per specifications requirements   9. The working area is maintained according to housekeeping standards |
| 1. Produce microbial enzymes | * 1. Medium is sterilized batch-wise as per work place procedures   2. Culture medium is formulated as per user needs   3. Microorganisms are isolated in culture media as per work place procedures   4. Inoculation is done as per the amount of inoculums required   5. Enzymes are purified as per work place procedures |
| 1. Carry out food tests | * 1. Test requests are received as per work place policies   2. Test methods are identified as per test request   3. Test equipment are obtained as per work place procedures   4. Samples and standards are prepared as per food testing requirements   5. Test procedures are performed on all sample and standards as per specified methods   6. Test results are recorded and validated as per work place procedures |
| 1. Preserve process foods | * 1. Storage and preservation conditions are identified as per set standard requirements   2. Storage conditions are monitored and regulated as per standard requirements   3. Preservation guidelines are adhered based on workplace instructions |

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range** |
| Standard operating procedures (SOPs)may include but not limited to: | * Receipts of production materials * Quality assessment of production materials * Disinfection procedures * Test procedures * Storage conditions requirements |
| Personal protective equipment (PPE) may include but not limited to: | * + Masks   + Gloves   + Safety hat   + Overall coats   + Gumboots |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

The individual needs to demonstrate knowledge of:

**Knowledge**

* Types food productions
* Food cultures
* Food microbiology
* Food tests
* Communication
* ICT

**SKILLS**

The individual needs to demonstrate the following skills:

* Testing techniques
* Enzyme production
* Food analysis
* Production of starter cultures
* Synthesis and evaluation
* Decision making
* Management
* Leadership

**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. Produced quality processed foods 2. Produced microbial enzymes 3. Carried out food tests and recorded findings 4. Preserved processed foods 5. Demonstrated understanding of quality food production 6. Demonstrated understanding of food testing methods |
| 1. Resource Implications for competence cetification | The following resources must be provided:   * 1. Access to relevant workplace where assessment can take place   2. Appropriately simulated environment where assessment can take place   3. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency may be accessed through:   * 1. Written tests   2. Oral questioning   3. Third party reports   4. Case studies |
| 1. Context of Assessment | Competency may be assessed:   1. On the job 2. Off the job 3. In work placement (attachment)   Off the job assessment must be undertaken in a closely simulated workplace environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry subsector, workplace and job roles is recommended. |

# MANAGE BIOTECHNOLOGY LABORATORY

**UNIT CODE:** MED/OS/BT/CR/07/6/A

**UNIT DESCRIPTION**

This unit specifies the competencies required to manage Biotechnology laboratory. It involves preparing laboratory specimens and samples, performing laboratory tests, maintaining laboratory equipment, recording, and interpreting laboratory results. It also includes **keeping accurate records and maintaining confidentiality**

**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. Prepare laboratory specimens and samples | * 1. Personal protection equipment and apparel (***PPEs***) are identified gathered and donned based on workplace procedures   2. Samples to be collected are identified as per laboratory test   3. Samples are collected as per compliance requirements.   4. Integrity of samples is maintained during sampling as per work place confidentiality standards   5. Laboratory samples are labeled, registered and recorded as per workplace procedures |
| 1. Perform laboratory tests | * 1. Personal protection equipment and appare**l** (***PPEs***) are identified, gathered and donned based on workplace procedure   2. Receive and document tests samples as per work place procedures   3. Tests samples are sorted and labeled as per work place procedures   4. The integrity of samples is preserved as per work place procedures   5. Sample and standards to be tested are prepared as per work place procedures   6. Methods of analysis are identified and applied according to test requirements   7. Unused reagents are stored, and wastes disposed as per relevant regulations and codes |
| 1. Maintain laboratory equipment | * 1. Test equipment and/or reagents are set up as per specified test method.   2. Pre-use and safety checks are conducted as per work place procedures   3. The calibration status of equipment is checked as per work place procedures   4. **Serviceability checks** are **performed on equipment as per work place procedures**   5. Routine maintenance is conducted as per manufactures manuals and workplace procedures   6. **Calibration/qualification checks** are **performed as per work place procedures** and per manufactures manuals |
| 1. Record and interpret laboratory results | * 1. Sample data is obtained as per work place procedures   2. Method of data analysis is chosen as per work place policy   3. Laboratory data are analyzed as per the test and work place procedures   4. Data analysis result are interpreted and recorded as per the test and work place procedures |
| 1. **Keep accurate records and maintain confidentiality** | * 1. Laboratory results are transcribed as per work place procedures   2. Accuracy of records is verified as per work place procedures   3. Records are filed and stored as per work place procedures   4. Records confidentiality is maintained as per work place confidentiality standards |

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Personal protective equipment (PPE) may include but not limited to: | * + Masks   + Gloves   + Safety hat   + Overall coats   + Gumboots   + Fume-cupboards   + Lamina flow bench   + Body showers |
| 1. Relevant regulations and codes may include but not limited to: | * Biosafety act, National Environmental Management * Authority(NEMA) * OSHA codes * Kenya bureau of Standards |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

The individual needs to demonstrate knowledge of:

**KNOWLEDGE**

* Communication
* Types of laboratories
* Types of specimens
* Laboratory informechanics
* Types of laboratory chemicals
* Laboratory standard operating procedures
* ICT
* Laboratory accidents, hazards and first aid

**SKILLS**

The individual needs to demonstrate the following skills:

* Laboratory management
* Sampling techniques
* ICT
* Data Analysis
* Data Synthesis and evaluation
* Decision making
* Management
* Leadership

**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, gathered and used PPEs correctly and appropriately 2. Prepared laboratory specimen and samples 3. Performed laboratory tests 4. Maintained laboratory equipment 5. Recorded and interpreted laboratory results 6. Kept accurate records and maintained confidentiality 7. **Demonstrated understanding of laboratory practices** 8. Demonstrated understanding of sampling techniques 9. Demonstrated understanding of record keeping 10. Demonstrated understanding of first aid techniques |
| 1. Resource Implications for competence cetification | The following resources must be provided:   * 1. Access to relevant workplace where assessment can take place   2. Appropriately simulated environment where assessment can take place   3. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency may be accessed through:  3.1Written tests  3.2 Oral questioning  3.3Third party reports  3.4 Case studies |
| 1. Context of Assessment | Competency may be assessed:   * 1. On the job   2. Off the job   3. In work placement (attachment)   Off the job assessment must be undertaken in a closely simulated workplace environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry subsector, workplace and job roles is recommended. |

GENETIC ENGINEERING

**UNIT CODE:** MED/OS/BT/CR/08/6/A

**UNIT DESCRIPTION**

This unit specifies the competencies required to perform genetic engineering. It involves outlining different classes of enzymes used in Genetic engineering, identifying cloning vectors and hosts and pplying cloning and transformation procedures in genetic engineering

**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. Outline different classes of enzymes used in Genetic engineering | * 1. Personal protection equipment and apparel(***PPEs***) are identified gathered and donned based on workplace procedures   2. Type of vector is selected as per genome size   3. Culture media is identified as per the **vector**   4. Restriction enzymes are selected as per the vector and genome type and gene of interest |
| 1. Identify cloning vectors and hosts | * 1. **Restriction enzyme** is selected as per gene of interest and vector   2. **Legating enzymes** are selected as per the restriction sites, gene of interest and vector   3. Recombinant DNA organism are cultured in appropriate media   4. Personal protection equipment and apparel(***PPEs***) are identified gathered and donned based on workplace procedures |
| 1. Apply cloning and transformation procedures in genetic engineering | * 1. Personal protection equipment and apparel(***PPEs***) are identified gathered and donned based on workplace procedures   2. Recombinant DNA are prepared for transfer to an appropriate organism based on standard techniques   3. Cloning technology is selected as per the culture   4. Recombinant cells are selected using appropriate markers.   5. Positive transformants are checked as per PCR procedures   6. Transgenes are multiplied according to standard procedures |

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range** |
| Restriction enzymes may include but not limited to: | * Ecor1, * HindII, * BamHI, * BtsCI, * FokI, * HaeIII |
| Personal protective equipment (PPE) may include but not limited to: | * + Masks   + Gloves   + Safety hat   + Overall coats   + Gumboots   + Fume-cupboards   + Lamina flow bench   + Body showers |
| Ligating enzymes may include but not limited to: | * + T3DNa Ligase   + T4 DNA Ligase   + T7 DNA ligase |
| Vectors may include but not limited to: | * + Plasmids   + Cosmids   + lamda phages |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

The individual needs to demonstrate knowledge of:

**Knowledge**

* Molecular biology
* Biochemistry
* Communication
* Types of laboratories
* Types of specimens
* Laboratory Infor mechanics
* Types of laboratory chemicals
* Laboratory standard operating procedures
* ICT
* Cell physiology
* Genetic Engineering
* Recombinant DNA technology

**SKILLS**

The individual needs to demonstrate the following skills:

* Communication
* Application of Information technology
* Data Analysis
* Tissue culture
* Synthesis and evaluation
* Decision making
* Management
* Leadership
* Cloning

**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 cloning vectors 2. Identified restriction enzymes 3. Performed cloning and transformation 4. Demonstrated ability to identify gene of interest 5. Demonstrated understanding of recombinant DNA technology 6. Purified recombinant DNA using appropriate kits |
| 1. Resource Implications | The following resources must be provided:   * 1. Assessment location/workplace   2. Tools and equipment relevant to the tasks (e.g. chemicals and equipment, apparatus and reagents)   3. PPEs, manuals and references   4. Laboratories   5. Case studies / scenarios relating to genetic engineering |
| 1. Methods of Assessment | Competency may be accessed through:   * 1. Written tests   2. Oral questioning   3. Third party reports   4. Case studies |
| 1. Context of Assessment | Competency may be assessed:   1. On the job 2. Off the job 3. In work placement (attachment)   Off the job assessment must be undertaken in a closely simulated workplace environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry subsector, workplace and job roles is recommended. |