****

**THE REPUBLIC OF KENYA**

**COMPETENCY BASED CURRICULUM**

**FOR**

**BIOTECHNOLOGY**

**LEVEL 5**



TVET CDACC

P.O. BOX 15745-00100

NAIROBI

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# FOREWORD

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

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

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

It is my conviction that this curriculum will play a great role towards development of competent human resource for 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. 4 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 labour force.

TVET Curriculum Development, Assessment and Certification Council (TVET CDACC) in conjunction with Biotechnology Sector Skills Advisory Committee (SSAC) have developed this curriculum.

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

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

I am grateful to the Council Members, Council Secretariat, Biotechnology SSAC, expert workers and all those who participated in the development of this curriculum.

**CHAIRPERSON,**

**TVET CDACC**

# ACKNOWLEDGMENT

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

I recognize with appreciation the role of the Biotechnology Sector Skills Advisory Committee (SSAC) in ensuring that competencies required by the industry are addressed in the curriculum. I also thank all stakeholders in Biotechnology sector for their valuable input and all those who participated in the process of developing this curriculum.

I am convinced that this curriculum will go a long way in ensuring that workers in Biotechnology Sector acquires the competencies that will enable them to perform their work more efficiently and effectively.

**COUNCIL SECRETARY/CEO**

**TVET CDACC**

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# ACRONYMS AND ABBREVIATIONS

AIDS Acquired Immunodeficiency Syndrome

MED Applied Science

CAL Computer Aided Learning

CBET Competency-Based Education and Training

CDACC Curriculum Development, Assessment and Certification Council

CV Coefficient of Variation

EMCA Environmental Management Co-ordination Act

EMS Environmental Management Systems

HIV Human Immunodeficiency virus

ICT Information Communication Technology

INAPH Information Network for Animal Productivity and Health

KNQA Kenya National Qualification Authority

NEMA National Environment Management Authority

OSH Occupational Safety and Health

PPEs Personal Protective Equipment

SOPs Standard Operating Procedures

TVET Technical and Vocational Education and Training

# KEY TO UNIT CODE

**MED/CU/BT/BC/01/5**/A

Industry or sector

Curriculum

Occupational area

Type of competency

Competency number

Competency level

Version control

# COURSE OVERVIEW

The units of competency comprising Biotechnology Level 5 qualification include the following: Biotechnology research activities, media solution preparation, industrial waste management, animal production, crop production food processing and biotechnology laboratory maintenance

**BASIC UNITS OF LEARNING**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit factor** |
| MED/CU/BT/BC/01/5/A | Communication skills | **25** | **2.5** |
| MED/CU/BT/BC/02/5/A | Numeracy Skills | 40 | 4.0 |
| MED/CU/BT/BC/03/5/A | Digital literacy | 45 | 4.5 |
| MED/CU/BT/BC/04/5/A | Entrepreneurial skills | 70 | 7.0 |
| MED/CU/BT/BC/05/5/A | Employability skills | 50 | 5.0 |
| MED/CU/BT/BC/06/5/A | Environmental literacy | 25 | 2.5 |
| MED/CU/BT/BC/07/5/A | Occupational safety and health practices | 25 | 2.5 |
| **Total** | | **280** | **28.0** |

**COMMON UNITS OF LEARNING**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit factor** |
| MED/CU/BT/CC/01/5/A | Biometrics | 45 | 4.5 |
| MED/CU/BT/CC/02/5/A | Cell biology and histology basics | 35 | 3.5 |
| MED/OS/BT/CC/03/5/A | Laboratory practice | 45 | 4.5 |
| MED/CU/BT/CC/04/5/A | Research project | 100 | 10 |
| **Total** | | **225** | **22.5** |

**CORE** **UNITS OF LEARNING**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit factor** |
| MED/CU/BT/CR/01/5/A | Biotechnology research activities | 96 | 9.6 |
| MED/CU/BT/CR/02/5/A | Media solution preparation | 60 | 6.0 |
| MED/CU/BT/CR/03/5/A | Industrial waste management | 60 | 6.0 |
| MED/CU/BT/CR/04/5/A | Animal production | 96 | 9.6 |
| MED/CU/BT/CR/05/5/A | Crop production | 96 | 9.6 |
| MED/CU/BT/CR/06/5/A | Food processing | 60 | 6.0 |
| MED/CU/BT/CR/07/5/A | Biotechnology laboratory maintenance | 80 | 8.0 |
|  | Industrial attachment | 360 | 36.0 |
| **Total** | | **908** | **90.8** |
| **Grand total** | | **1493** | **149.3** |

**Entry Requirements**

An individual entering this course should have any of the following minimum requirements:

1. Kenya Certificate of Secondary Education (KCSE) mean grade D (Plain)

**OR**

1. Artisan certificate level 4 in Biotechnology

**OR**

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

**Trainer qualification**

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

**Assessment**

The course will be assessed at two levels:

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

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

**Certification**

An individual will be awarded a Certificate of Competency on demonstration of competence in a unit of competency. To be awarded Certificate in Biotechnology Certificate Level 5, an individual must demonstrate competence in all the units of competency.

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

# BASIC UNITS OF LEARNING

# COMMUNICATION SKILLS

**UNIT CODE:** MED/CU/BT/BC/01/5/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Demonstrate communication skills

**Duration of Unit:** 25hours

**Unit Description**

This unit describes the competencies required to use specialized communication skills to meet specific needs of internal and external clients, conduct interviews, facilitate discussion with groups and contribute to the development of communication strategies.

**Summary of Learning Outcomes**

1. Meet communication needs of clients and colleagues
2. Contribute to the development of communication strategies
3. Conduct interviews
4. Facilitate group discussions
5. Represent the organization

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

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

**Suggested Delivery Methods**

* Interview
* Role playing
* Observation
* Viewing of related videos

**Recommended Resources**

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

# NUMERACY SKILLS

**UNIT CODE:** MED/CU/BT/BC/02/5/A

**Relationship to Occupational Standards:**

This unit addresses the unit of competency: Demonstrate numeracy skills

**Duration of Unit:** 40 hours

**Unit Description**

This unit covers the competencies required to perform numerical functions. The person who is competent in this unit shall be able to: Calculate with whole numbers and familiar fractions, decimals and percentages for work; Estimate, measure, and calculate with routine metric measurements for work; Use routine maps and plans for work; Interpret, draw and construct 2D and 3D shapes for work; Interpret routine tables, graphs and charts for work; Collect data and construct routine tables and graphs for work; and Use basic functions of calculator

**Summary of Learning Outcomes**

1. Calculate with whole numbers and familiar fractions, decimals and percentages for work
2. Estimate, measure and calculate with routine metric measurements for work
3. Use routine maps and plans for work
4. Interpret, draw and construct 2D and 3D shapes for work
5. Interpret routine tables, graphs and charts for work
6. Collect data and construct routine tables and graphs for work
7. Use basic functions of calculator

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

|  |  |  |
| --- | --- | --- |
| Learning Outcome | Content | Suggested Assessment Methods |
| 1. Calculate with whole numbers and familiar fractions, decimals and percentages for work | * + Interpretation of whole numbers, fractions, decimals, percentages and rates   + Calculations involving several steps   + Calculation with whole numbers and routine or familiar fractions, decimals and percentages   + Conversion between equivalent forms of fractions, decimals and percentages   + Application of order of operations to solve multi-step calculations   + Application of problem-solving strategies   + Making estimations to check reasonableness of problem-solving process, outcome and its appropriateness to the context and task   + Use of formal and informal mathematical language and symbolism to communicate the result of a task | * Oral * Written * Practical test * Observation |
| 2. Estimate, measure and calculate with routine metric measurements for work | * Selection and interpretation of measurement information in workplace tasks and texts * Identification and selection of routine measuring equipment * Estimation and making measurements using correct units * Estimation and calculation using routine measurements * Performing conversions between routinely used metric units * Using problem solving processes to undertake tasks * Recording information using mathematical language and symbols | * Oral * Written * Practical test * Observation |
| 3. Use routine maps and plans for work | * Identification of features in routine maps and plans * Symbols and keys used in routine maps and plans * Identification and interpretation of orientation of map to North * Demonstrate understanding of direction and location * Apply simple scale to estimate length of objects, or distance to location or object * Give and receive directions using both formal and informal language | * Oral * Written * Practical test * Observation |
| 4. Interpret, draw and construct 2D and 3D shapes for work | * Identify two dimensional shapes and routine three-dimensional shapes in everyday objects and in different orientations * Explain the use and application of shapes * Use formal and informal mathematical language and symbols to describe and compare the features of two-dimensional shapes and routine three dimensional shapes * Identify common angles * Estimate common angles in everyday objects * Use formal and informal mathematical language to describe and compare common angles * Use common geometric instruments to draw two dimensional shapes * Construct routine three dimensional objects from given nets |  |
| 5. Interpret routine tables, graphs and charts for work | * Identify routine tables, graphs and charts in predominately familiar texts and contexts * Identify common types of graphs and their different uses * Identify features of tables, graphs and charts * Locate specific information * Perform calculations to interpret information * Explain how statistics can inform and persuade * Identify misleading statistical information * Discuss information relevant to the workplace | * Oral * Written * Practical test * Observation |
| 6. Collect data and construct routine tables and graphs for work | * Identify features of common tables and graphs * Identify uses of **different tables and graphs** * Determine data and variables to be collected * Determine audience * Select a method to collect data * Collect data * Collate information in a table * Determine suitable scale and axes * Draft and draw graph to present information * Check that data meets the expected results and context * Report or discuss information using formal and informal mathematical language | * Oral * Written * Practical test * Observation |
| 7. Use basic functions of calculator | * Identify and use keys for **basic functions on a calculator** * Calculate using whole numbers, money and routine decimals and percentages * Calculate with routine fractions and percentages * Apply order of operations to solve multi-step calculations * Interpret display and record result * Make estimations to check reasonableness of problem-solving process, outcome and its appropriateness to the context and task * Use formal and informal mathematical language and appropriate symbolism and conventions to communicate the result of the task | * Oral * Written * Practical test * Observation |

**Suggested Delivery Methods**

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

**Recommended Resources**

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

# DIGITAL LITERACY

**UNIT CODE:** MED/CU/BT/BC/03/5/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate digital literacy

**Duration of Unit:** 45 hours

**Unit Description**

This unit describes competencies required to use a computer and other digital devices for the purposes of communication, work performance and management at the workplace.

**Summary of Learning Outcomes**

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

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

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

**Suggested Delivery Methods**

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

**Recommended Resources**

* Desk top computers
* Laptop computers
* Other digital devices
* Printers
* Storage devices
* Internet access
* Computer software

# ENTREPRENEURIAL SKILLS

**UNIT CODE:** MED/CU/BT/BC/04/5/A

**Relationship to occupational standards**

This unit addresses the unit of competency: Demonstrate entrepreneurial skills

**Duration of unit:** 70 hours

**Unit description**

**Unit description**

This unit describes the competencies critical to demonstration of entrepreneurial aptitudes. It involves, developing business innovation strategies, developing new markets, customer base, expanding employed capital and undertaking regional/county expansion while retaining motivated staff.

**Summary of Learning Outcomes**

1. Develop business innovation strategies
2. Develop new products/ markets
3. Expand customers and product lines
4. Motivate all staff/workers
5. Expand employed capital base
6. Undertake regional/county business expansion

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Develop business Innovation strategies | * Innovation in business * Business innovation strategies * Creativity for business development * New technologies in entrepreneurship * Linkages with other entrepreneurs * Setting strategic directions * New ideas and approaches * Entrepreneurial skills development * Market trends * Monitoring and anticipating market trends * Products and processes in entrepreneurship * Business conventions ad exhibitions * Business growth refocus | * Observation * Case studies * Individual/group assignments   Projects   * Written * Oral |
| 1. Develop new products/ markets | * Feasibility study for new products * Identifying new sources of raw material and resources * New target markets/customers * Increasing products and services * Marketing improvement * Intrapreneurship and business growth | * Observation * Case studies * Individual/group assignments * Projects * Written * Oral |
| 1. Expand customers and product lines | * Market demand * Regulatory environment * Creating product and services competitive advantages * Creating royal client base * Identifying and maintain new customers and markets * Advance product/ service promotions * Advance market expansion * Small business records management * Book keeping and auditing for small businesses * Computer application software and programmes * ICT in customer and product diversification | * Oral * Observation * Case studies * Individual/group assignments * Projects * Written |
| 1. Motivate staff/workers | * Motivation of workers   `Communication at workplace for motivation purpose   * Problem solving * Conflict resolution at place of work * Good staff/workers relation * Team building and team work * Staff development and enhancement * Culture of continuous improvement | * Observation * Case studies * Individual/group assignments * Projects * Written |
| 1. Expand employed capital base | * Employed capital in business * Business share holdings * Types of shares * Shares diversification * Role of shareholders * Entrepreneurship * Increasing products and services | * Observation * Case studies * Individual/group assignments * Projects * Written * Oral |
| 1. Undertake county/ regional business expansion | * Region/ county identification process * Regional/ county laws and regulation * Business regional/county expansion * Regional/ County business expansion * Innovation in business * Business expansion and diversification * Resources for regional/county expansion * Small business Strategic Plan * Computer software in business development * ICT and business growth | * Observation * Case studies * Individual/group assignments * Projects * Written * Oral |

**Suggested Delivery Methods**

* Instructor led facilitation of theory
* Demonstration by trainer
* Practice by trainee
* Role play
* Case study

**Recommended Resources**

* Case studies for small businesses
* Business plan templates
* Laptop/ desktop computers
* Internet
* Telephone
* Writing materials

# EMPLOYABILITY SKILLS

**UNIT CODE:** MED/CU/BT/BC/05/5/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate employability skills

**Duration of Unit:** 50 hours

**Unit Description**

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

**Summary of Learning Outcomes**

1. Conduct self-management

2. Demonstrate interpersonal communication

3. Demonstrate critical safe work habits

4. Lead small teams

5. Plan and organize work

6. Maintain professional growth and development

7. Demonstrate workplace learning

8. Demonstrate problem solving skills

9. Demonstrate workplace ethics

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Conduct self-management | * Self-awareness * Formulating personal vision, mission and goals * Strategies for overcoming life challenges * Emotional intelligence * Assertiveness versus aggressiveness * Expressing personal thoughts, feelings and beliefs * Developing and maintaining high self-esteem * Developing and maintaining positive self-image * Articulating ideas and aspirations * Accountability and responsibility * Good work habits * Self-awareness * Self-development * Financial literacy * Healthy lifestyle practices | * Observation * Written * Oral interview * Third party report |
| 1. Demonstrate interpersonal communication | * Meaning of interpersonal communication * Listening skills * Types of audience * Writing skills * Reading skills * Meaning of empathy * Understanding customers’ needs * Establishing communication networks * Sharing information | * Observation * Written * Oral interview * Third party report |
| 1. Demonstrate critical safe work habits | * Stress and stress management * Punctuality and time consciousness * Leisure * Integratingpersonal objectives into organizational objectives * Resources utilization * Setting work priorities * HIV and AIDS * Drug and substance abuse * Handling emerging issues | * Observation * Written * Oral interview * Third party report |
| 1. Lead a small team | * Leadership qualities * Team building * Determination of team roles and objectives * Team performance indicators * Responsibilities in a team * Forms of communication * Complementing team activities * Gender and gender mainstreaming * Human rights * Maintaining relationships * Conflicts and conflict resolution | * Observation * Oral interview * Written * Third party report |
| 1. Plan and organize work | * Functions of management * Planning * Organizing * Time management * Decision making process * Task allocation * Evaluating work activities * Resource utilization * Problem solving * Collecting and organising information | * Observation * Oral interview * Written * Third party report |
| 1. Maintain professional growth and development | * Opportunities for professional growth * Assessing training needs * Licenses and certifications for professional growth and development * Pursuing personal and organizational goals * Identifying work priorities * Recognizing career advancement | * Observation * Oral interview * Written * Third party report |
| 1. Demonstrate workplace learning | * Managing own learning * Contributing to the learning community at the workplace * Cultural aspects of work * Variety of learning context * Application of learning * Safe use of technology * Identifying opportunities * Generating new ideas * Workplace innovation * Performance improvement * Handling emerging issues * Future trends and concerns in learning | * Observation * Oral interview * Written * Third party report |
| 1. Demonstrate problem solving skills | * Problem identification * Problem solving * Application of problem-solving strategies * Resolving customer concerns | * Observation * Oral interview * Written * Third party report |
| 1. Demonstrate workplace ethics | * Meaning of ethics * Ethical perspectives * Principles of ethics * Values and beliefs * Ethical standards * Organization code of ethics * Common ethical dilemmas * Organization culture * Corruption, bribery and conflict of interest * Privacy and data protection * Diversity, harassment and mutual respect * Financial responsibility/accountability * Etiquette * Personal and professional integrity * Commitment to jurisdictional laws * Emerging issues in ethics | * Observation * Oral interview * Written * Third party report |

**Suggested Methods of Delivery**

* Instructor lead facilitation of theory
* Demonstrations
* Simulation/Role play
* Group Discussion
* Presentations
* Projects
* Case studies
* Assignments

**Recommended Resources**

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

# ENVIRONMENTAL LITERACY

**UNIT CODE:** MED/CU/BT/BC/06/5/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Demonstrate environmental literacy

**Duration of Unit:** 25 hours

**Unit Description**

This unit describes the competencies required to control environmental hazard, control environmental pollution, comply with workplace sustainable resource use, evaluate current practices in relation to resource usage, identify environmental legislations/conventions for environmental concerns, implement specific environmental programs and monitor activities on environmental protection/programs.

**Summary of Learning Outcomes**

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

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

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

**Suggested Delivery Methods**

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

**Recommended Resources**

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

# OCCUPATIONAL SAFETY AND HEALTH PRACTICES

**UNIT CODE:** **MED**/CU/BT/BC/07/5/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Demonstrate occupational safety and health practices

**Duration of Unit:** 25 hours

**Unit Description**

This unit describes the competencies required to comply with regulatory and organizational requirements for occupational safety and health.

**Summary of Learning Outcomes**

1. Identify workplace hazards and risk
2. Identify and implement appropriate control measures to hazards and risks
3. Implement OSH programs, procedures and policies/guidelines

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify workplace hazards and risks | * Identification of hazards in the workplace and/or the indicators of their presence * Evaluation and/or work environment measurements of OSH hazards/risk existing in the workplace is conducted by * Authorized personnel or agency * Gathering of OHS issues and/or concerns raised | * Oral questions * Written tests * Observation of trainees identify hazards and risks |
| 1. Identify and implement appropriate control measure to hazards and risks | * Prevention and control measures, including use of PPE (personal protective equipment) for specific hazards are identified and implemented * Appropriate risk controls based on result of OSH hazard evaluation is recommended * Contingency measures, including emergency procedures during workplace incidents and emergencies are recognized and established in accordance with organization procedures | * Oral questions * Written tests * Practical test * Observation of implementation of control measures |
| 1. Implement OSH   programs, procedures  and policies/guidelines | * Providing information to work team about company OHS program, procedures and policies/guidelines * Participating in implementation of OSH procedures and policies/ guidelines * Training of team members and advice on OSH standards and procedures * Implementation of procedures for maintaining OSH-related records | * Oral questions * Written tests * Practical test * Observation |

**Suggested Delivery Methods**

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

**Recommended Resources**

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

# COMMON UNITS OF LEARNING

# **BASIC BIOMETRICS**

**UNIT CODE:** MED/CU/BT/CC/01/5/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate understanding of basic biometrics.

**Duration of Unit:** 45 Hours

**Unit Description**

This unit specifies the competencies required to demonstrate understanding of basics biometrics. It includes: Understanding basic statistics, statistical models, biometric data and how to infer biostatistics data.

**Summary of Learning Outcomes**

1. Understand basic statistics
2. Understand basic statistical models
3. Understand basic biometric data
4. Understand how to infer biostatistics data

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Understand basic statistics | * Definition of terms * Differentiation of qualitative and quantitative variables * Determination of range of measurement * Calculation of mean of measurement * Calculation of median of data set sampled * Identification of mode * Calculation of standard deviation * Calculation of variance * Hypothesis testing. | * Written tests * Case study * Third party report |
| 1. Understand basic statistical models | * Definitions * Calculation of T-test/F-test Determination randomized design model of the experimental * Randomized complete block design model * Parametric and non-parametric models of the experiment | * Written tests * Third party report |
| 1. Determine basic biometric data | * Probability testing * Relationships between the dependent and independent variables of the experimental units * Determination of linear correlation effects * Linear regression analyses | * Written tests * Observation * Third party report |
| 1. Understanding how to infer biometric data. | * Confidence intervals of the experimental data * Inference of hypotheses * Coefficient of variation (CV) * Drawing conclusion | * Written tests * Observation * Third party report |

**Suggested Methods of instructions:**

* Direct instruction
* Project
* Case studies
* Group discussions
* Demonstration by trainer
* Practical
* Industrial attachment
* Audio visual /Simulataions
* Assignments

**List of Recommended Resources:**

* Computers
* Biometric tools
* Books/ journal and reports
* Standard manuals/SOPs
* Projectors
* Writing materials
* Internet
* Relevant videos
* Scientific calculators

# CELL BIOLOGY AND HISTOLOGY BASICS

**UNIT CODE:** MED/CU/BT/CC/02/5/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate basic knowledge of cell biology and histology.

**Duration of Unit:** 35 Hours

**Unit Description**

This unit specifies the competencies required to demonstrate basic knowledge of cell biology and histology. It involves identifying cell structure and function, demonstrating knowledge of cell and cell division, Identification of histological and cytological study methods, demonstrating knowledge of types of tissues and their function, cell totipotency and basic DNA and gene function.

**Summary of Learning Outcomes**

1. Identify cell structure and function
2. Demonstrate the knowledge of cell and cell division
3. Identify histological and cytological study methods
4. Demonstrate knowledge of types of tissues and their function
5. Demonstrate understanding of cell totipotency
6. Understand basic DNA and gene function

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify cell structure and function | * Definition of terms * Identification of cell structures * Interpretation of physiological parameters | * Written tests * Practicals * Oral questions |
| 1. Demonstrate the knowledge of cell and cell division | * Definition of terms * Identification of cell types * Components of cell cycle * Processes of cell division * Composition of cytoplasm | * Written tests * Practicals * Oral questions |
| 1. Identify histological and cytological methods | * Definition of terms * Determination of histochemical methods * Identification of chemical methods * Identification of physical methods * Staining methods * Identification of immune-histochemical methods * X-ray diffraction | * Written tests * Practicals * Oral questioning * Third party report |
| 1. Demonstrate knowledge of types of tissues and their function | * Definition of terms * Tissue location * Identification of embryonic tissues * Identification of tissue types | * Written tests * Practicals * Oral questions * Third party report |
| 1. Demonstrate understanding of cell totipotency | * Definition of terms * Cell regeneration * Cell / Tissue culture | * Written tests * Practicals * Oral questions * Third party report |
| 1. Understand basic DNA and gene function | * DNA structure * DNA replication * Basic DNA transcription * Basic DNA translation | * Written tests * Practicals * Oral questions * Third party report |

**Suggested Methods of instructions:**

* Direct instruction
* Project
* Case studies
* Group discussions
* Field /site visits
* Demonstration by trainer
* Practicals
* Industrial attachment
* Audiovisual/ simulations
* Assignments

**List of Recommended Resources:**

* Biotechnology Laboratory
* Microscopes
* Computers
* Standard manuals/SOPs
* Projectors
* Internet
* Writing materials
* Books/Journal and reports
* Specimens
* Relevant videos
* Printers

# LABORATORY PRACTICE

**UNIT CODE:** MED/CU/BT/CC/03/5/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate basic knowledge of laboratory practice.

**Duration of Unit:** 45 Hours

**Unit Description**

This unit specifies the competencies required to demonstrate basic knowledge of laboratory practice. It involves applying safety precautions in the laboratory, demonstrating basic understanding of laboratory design, carrying out basic repair and maintenance of equipment, handling laboratory chemicals/specimens, carrying out first aid operations procedures and keeping accurate inventory records.

**Summary of Learning Outcomes**

1. Apply safety precautions in the laboratory
2. Demonstrate basic understanding of laboratory design
3. Carry out basic repair and maintenance of equipment
4. Handle laboratory chemicals/specimens
5. Carry out first aid operations procedures
6. Keep accurate inventory records

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Application of safety precautions in the laboratory | * + Definition of terms   + Identification of PPEs   + Occupation safety and health in the Laboratory   + Laboratory equipment/ apparatus | * Written tests * Practicals * Oral questions |
| 1. Demonstration of basic understanding of laboratory design | * + Definition of terms   + Laboratory sections   + Laboratory utilities   + Waste management in the Laboratory | * Written tests * Practicals * Oral questions |
| 1. Carry out basic repair and maintenance of equipment | * Definition of terms * Maintenance of Laboratory equipment * Calibration of equipment * Routine test and check of equipment | * Written tests * Practicals * Oral questioning * Third party report |
| 1. Handle laboratory chemicals/specimens | * Definition of terms * Laboratory chemicals * Laboratory specimens * Reagent preparation * Chemical disposal * Chemical storage | * Written tests * Practicals * Oral questions * Third party report |
| 1. Carry out first aid operations procedures | * Definition of terms * Nature of the accident /emergency * First aid methods * First aid kit * Reporting accident /emergency | * Written tests * Practicals * Oral questions * Third party report |
| 1. Keep accurate inventory records | * Definition of terms * Record keeping * Types of records | * Written tests * Practicals * Oral questions * Third party report |

**Suggested Methods of instructions:**

* Direct instruction
* Project
* Case studies
* Group discussions
* Demonstration by trainer
* Practicals
* Industrial attachment
* Audiovisual/ simulations
* Assignments

**List of Recommended Resources:**

* Biotechnology Laboratory
* Microscopes
* Computers
* Standard manuals/SOPs
* Projectors
* Internet
* Writing materials
* Books/Journal and reports
* Specimens
* Relevant videos
* Printers

# RESEARCH PROJECT

**UNIT CODE:** MED/CU/BT/CC/04/**5**/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate understanding of research project

**Duration of Unit:** 100 Hours

**Unit Description**

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

**Summary of Learning Outcomes**

1. Identify a research problem
2. Formulate hypothesis or research questions
3. Conduct literature review
4. Develop research design and methodology
5. Prepare research proposal
6. Conduct data collection
7. Conduct basic data analysis and presentation
8. Prepare basics research report

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify a research problem | * + Definition of terms   + Identification of research problem   + Definition of scope of study   + Formulation of research title | * Written tests * Observation * Case study * Oral questions * Third party report |
| 1. Formulate hypothesis or research questions | * + Definition of terms   + Identification of research objectives     - Specific objectives     - General objectives   + Establishment of research questions   + Formulation of hypothesis     - Null-hypothesis     - Void hypothesis | * Written tests * Observation * Oral questions * Third party report |
| 1. Conduct literature review | * Definition of terms * Information sources * Analysis of information sources * Citation of relevant information | * Written tests * Observation * Oral questioning * Third party report |
| 1. Develop research design and methodology | * Identification of study site/location * Identification of materials, methods and procedures * Preparation of schedules * Research budget preparation * Research work plan * Identification of research designs * Selection of sampling techniques * Selection of data analysis techniques * Determination of validity and reliability of research instruments * Research outputs | * Written tests * Observation * Oral questions * Third party report |
| 1. Prepare research proposal | * Identification of research proposals * Formulation of research proposals * Determination of general topic * Literature review * Gap identification * Problem statement * Determination of research methods * Determination of investigation methods * Determination of sample size and characteristics * Determination of data collection and analysis procedures | * Written tests * Observation * Oral questions * Third party report |
| 1. Conduct data collection | * Identification of data collection tools * Identification and assessment of data sources * Analysis of data collection methods * Collection of data | * Written tests * Observation * Oral questions * Practicals * Third party report |
| 1. Conduct basic data analysis and presentation | * Data analysis procedures and protocols * Analysis and interpretation of data * Processing and presentation of data | * Written tests * Observation * Practicals * Oral questions * Third party report |
| 1. Prepare basic research report | * Identification of research report format * Preparation of research report * Determination of research findings * Presentation of research findings * Research recommendations | * Written tests * Observation * Oral questions * Third party report |

**Suggested Methods of instructions:**

* Direct instruction
* Project
* Case studies
* Group discussions
* Field trips /site visits
* Demonstration by trainer
* Practice by the trainees
* Industrial attachment
* Viewing of related videos

**List of Recommended Resources:**

* Computers
* Standard manuals/SOPs
* Projectors
* Flip charts
* Charts with presentations of data
* Internet
* Relevant videos
* Printers
* Research journals and publication

# CORE UNITS OF LEARNING

# BIOTECHNOLOGY RESEARCH ACTIVITIES

**UNIT CODE:** MED/CU/BT/CR/01/5/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Participate in biotechnology research activities

**Duration of Unit:** 96 Hours

**Unit Description**

This unit specifies the competencies required to participate in biotechnology research activities. It involves Setting up operational equipment, handling laboratory chemicals, preparing chemical/ reagents, carrying out test and experiments, collecting and recording of research data and maintaining laboratory equipment.

**Summary of Learning Outcomes**

1. Set up operational equipment
2. Handle laboratory chemicals
3. Prepare chemical/ reagents
4. Carry out tests and experiments
5. Collect and record research data
6. Maintain laboratory equipment

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Setting up operational equipment | * + Definition of terms   + Preparation of PPEs   + Occupational safety and health procedures   + Types of instruments and equipment   + Laboratory set up | * Written tests * Observation * Practicals * Case study * Oral questions * Third party report |
| 1. Handle laboratory chemicals | * + Identification of PPEs   + Identification and classification of chemicals   + Storage of lab chemicals   + Retrieval and usage of lab chemicals * Waste disposal | * Written tests * Observation * Practicals * Oral questions * Third party report |
| 1. Prepare chemical/ reagents | * + Definition of terms   + Preparation of PPEs   + Occupational safety and health procedures   + Environmental protection measures   + Preparation of chemical reagents   + Storage of chemical reagents | * Written tests * Observation * Practicals * Oral questions * Third party report |
| 1. Carry out tests and experiments | * + Definition of terms   + Preparation of PPEs   + Occupational safety and health procedures   + Environmental protection measures   + Experimental setup design   + Effects of dependent variables   + Data collection | * Written tests * Observation * Practicals * Oral questioning * Third party report |
| 1. Collect and record research data | * + Definition of terms * Retrieval and processing of data * Verification of recorded quality * Rectification of errors in data * Calculation of statistical values * Data interpretation * Storage of workplace records | * Written tests * Observation * Oral questions * Third party report |
| 1. Maintain laboratory equipment | * Definition of terms * Identification of faulty or unsafe components and equipment * Fault identification/trouble-shooting * Preparation of maintenance schedules * Maintenance procedures, records and safety requirements * Operation of instruments and equipment * Maintenance of instruments and equipment * Occupational safety and health procedures * Environmental protection measures | * Written tests * Observation * Oral questions * Third party report |

**Suggested Methods of instruction:**

* Direct instruction
* Project
* Case studies
* Group discussions
* Field /site visits
* Demonstration by trainer
* Practice by the trainees
* Industrial attachment

**List of Recommended Resources:**

* Computers
* Standard manuals/SOPs/books
* Projectors
* Flip charts
* Internet
* Relevant videos
* Printers

# **MEDIA SOLUTION PREPARATION**

**UNIT CODE:** MED/CU/BT/CR/02/5/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Prepare media culture.

**Duration of Unit:** 60 hours

**Unit description:**

This unit specifies the competencies required in preparation of media solution. It involves Preparing media apparatus and equipment, preparing stock solutions, maintaining stock solution, preparing culture media, managing media storage and carrying out sterilization of media.

**Summary of Learning Outcomes**

1. Preparing media apparatus and equipment
2. Prepare stock solutions
3. Maintain stock solutions
4. Prepare culture media
5. Manage medias storage
6. Carry out media sterilization

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Preparing media apparatus and equipment | * Definition of terms * Acquisition of PPES * Media apparatus and equipment * Sterilization | * Written tests * Practicals * Oral questioning * Third party report |
| 1. Prepare stock solutions | * Definition of terms * Acquisition of PPES * Stock formulation and measurement * Stock constituents * Types of stock solution * Sterilization of stock solutions * Storage | * Written tests * Practicals * Oral questioning * Third party report |
| 1. Maintain stock solution | * Definition of terms * Types of stock solutions * Preservation methods * Labelling of stack solutions | * Written tests * Observation * Practicals * Oral questions * Third party report |
| 1. Prepare media culture | * Definition of terms * Acquisition of PPES * Types of media * Media ingredients/components * Media standardization | * Written tests * Observation * Practicals * Oral questioning * Third party report |
| 1. Manage media storage | * Definition of terms * Acquisition of PPES * Media labelling * Media batches * Media handling * Storage of batches of media | * Written tests * Observation * Practical * Oral questioning * Third party report |
| 1. Media sterilization | * Definition of terms * Acquisition of PPES * Methods and types of sterilization * Sterilizer loading * Placement of sterilization indicator * Operation of sterilization cycle * Cooling of media | * Written tests * Observation * Practicals * Oral questioning * Third party report |

**Suggested Methods of Instructions:**

* Direct instruction
* Project
* Case studies
* Group discussions
* Demonstration by trainer
* Practicals
* Industrial attachment

**List of Recommended Resources:**

* Computers
* Standard manuals/SOPs
* Projectors
* Writing materials
* Internet
* Audio visual
* Biotechnology laboratory

# INDUSTRIAL WASTE MANAGEMENT

**UNIT CODE:** MED/CU/BT/CR/03/5/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Manage industrial waste

**Duration of Unit:** 60hours

**Unit Description**

This unit specifies the competencies required to manage industrial waste. It involves classifying industrial wastes, managing industrial waste, controlling industrial pollution, utilizing industrial waste and cleaning and decommissioning of tanks.

**Summary of Learning Outcomes**

1. Classify industrial waste
2. Manage industrial waste
3. Control industrial pollution
4. Utilize industrial waste
5. Clean and decommission tanks

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Classify industrial waste | * + Definition of terms   + Acquisition of PPES   + Classification of industrial waste | * Written tests * Observation * Practicals * Oral questioning * Third party report |
| 1. Manage industrial waste treatment | * + Definition of terms   + Identification and use of PPEs   + Occupational safety and health procedures   + Segregation of industrial wastes   + Determination of industrial waste for treatment   + Environmental waste legislation   + Waste management systems   + Environmental protection measures | * Written tests * Observation * Practicals * Oral questioning * Third party report |
| 1. Control industrial pollution | * + Definition of terms   + Identification and use of PPEs   + Occupational safety and health procedures   + Determination of pollution nature   + Methods of industrial pollution control   + Tools, equipment and materials for pollution control   + Application of appropriate methods of pollution control   + Environmental laws and regulations | * Written tests * Observation * Practicals * Oral questions * Third party report |
| 1. Utilize industrial waste | * + Identification of industrial wastes   + Analysis of industrial wastes   + Determination waste properties     - Chemical     - Physical     - Biological   + Industrial waste by-products | * Written tests * Observation * Practicals * Oral questions * Third party report |
| 1. Cleaning of tanks and decommissioning | * + Personal protective equipment   + Occupational safety and health procedures   + Different types of equipment, tools and apparatus used   + Tank decommissioning materials   + Methods of decommissioning.   + Environmental protection measures | * Written tests * Observation * Practicals * Third part report. * Oral questioning |

**Suggested Methods of Instructions:**

* Direct instruction
* Project
* Case studies
* Field visits
* Discussions
* Demonstration by trainer
* Practicals
* Industrial attachment
* Assignments

**List of Recommended Resources:**

* Books
* Computers
* Stationery
* Standard operating procedures (SOPs)
* Projectors
* Charts with presentations of data
* Internet
* Relevant videos

# ANIMAL PRODUCTION

**UNIT CODE:** MED/CU/BT/CR/04/5/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Improve animal production

**Duration of Unit:** 96 Hours

**Unit Description**

This unit specifies the competencies required in improving animal production. It involves Preparing animal feeds, implementing animal’s feeding programme, preventing and participating in the control of animal diseases and participating in animal breeding.

**Summary of Learning Outcomes**

1. Prepare animal feeds
2. Implement animal’s feeding programme
3. Prevent and participate in the control of animal diseases
4. Participate in animal breeding

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Prepare animal feeds | * + Definition of terms   + Identification and use of PPEs   + Determination of animal nutritional requirements   + Ingredients for animal feeds production   + Preparation of animal feeds ingredients   + Formulation of animal feeds   + Application of animal feed production technologies | * Written tests * Observation * Practicals * Oral questioning * Third party report |
| 1. Implement animal’s feeding programme | * + Sources of animal feeding   + Balancing animal feeding ratio   + Feeding animals   + Storage of animal feeding | * Written tests * Observation * Practicals * Oral questions * Third party report |
| 1. Prevent and participate in the control of animal diseases | * + Definition of terms   + Identification and use of PPEs   + Animal disease   + Identification of sick animals   + Disease prevention measures   + Disease sample collection   + Processing of samples   + Identification of diseases causing organisms   + Biotechnological methods | * Written tests * Observation * Practical * Oral questions * Third party report |
| 1. Participate in animal breeding | * + Personal protective equipment   + Occupational safety and health procedures   + Identification of individual animal information   + Physical examination of animals   + Different types of equipment, tools and apparatus used   + Fertility tests   + Artificial insemination   + Information Network for Animal Productivity and Health (INAPH) guidelines   + Selection of best animals   + Methods of Animal breeding | * Observation * Case studies * Oral * Third party report |

**Suggested Methods of Instructions:**

* Direct instruction
* Project
* Case studies
* Field trips/site visits
* Discussions
* Demonstration by trainer
* Practice by the trainee

**List of Recommended Resources:**

* Computers
* SOPs
* Projectors
* Flip charts
* Stationary
* Relevant charts and journals
* Internet
* Relevant videos
* Livestock units

# CROP PRODUCTION

**UNIT CODE:** MED/CU/BT/CR/05/5/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Improve crop production

**Duration of Unit:** 96Hours

**Unit Description**

This unit specifies the competencies required in improving crop production. It involves Preparing plant materials, preparing experimental layouts, undertaking breeding activities, collecting and recording data.

**Summary of Learning Outcomes**

1. Prepare plant materials
2. Prepare experimental layouts
3. Undertake breeding activities
4. Collect and record data

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Prepare plant materials | * Definition of terms * Personal protective equipment * Selection of planting materials * Classification of planting materials * Methods of treatment of the planting materials | * Observation * Case studies * Practicals * Oral * Third party report |
| 1. Prepare experimental layouts | * Definition of terms * Personal protective equipment * Experimental designs and layouts * Plant populations * Site characteristics * Site demarcations | * Written tests * Observation * Practicals * Oral questioning * Third party report |
| 1. Undertake breeding activities | * Definition of terms * Personal protective equipment * Methods of breeding techniques * Plant propagation methods * Methods of selection/screening * Sample collection * Plant tissue culture * Methods of characterization | * Written tests * Observation * Practicals * Oral questions * Third party report |
| 1. Collect and record data | * Definition of terms * Methods of data collection * Tools of data collection * Data processing * Data analysis | * Written tests * Observation * Oral questions * Third party report |

**Suggested Methods of Instructions:**

* Direct instruction
* Project
* Case studies
* Field trips/ site visit
* Computer aided learning
* Group discussions
* Demonstration by trainer
* Practice by the trainees
* Relevant video shows

**List of Recommended Resources**

* Computer
* Manuals
* Books
* Stationaries
* Workstation
* Biotechnology tools and equipment
* Greenhouses/Screenhouse/Glasshouse
* Biotechnology field
* Flip charts
* Journals
* Internet connectivity

# FOOD PROCESSING

**UNIT CODE:** MED/CU/BT/CR/06/5/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Process quality food

**Duration of Unit:** 60 Hours

**Unit Description**

This unit specifies the competencies required in processing quality food. It involves Preparing food materials, producing quality foods, preparing microbial enzymes, performing food tests and preserving processed food.

**Summary of Learning Outcomes**

1. Prepare food materials
2. Produce quality food
3. Prepare microbial enzymes
4. Perform food tests
5. Preserve processed foods

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Prepare food materials | * Definition of terms * Identification and use of PPEs * Sources of food materials * Types of food material * Food material tests * Food preparation technologies | * Observation * Case studies * Practicals * Oral questions * Third party report |
| 1. Produce quality food | * Definition of terms * Identification and use of PPEs * Method of collecting quality raw materials * Types of food cultures * Quality assurance processes and techniques * Food production equipment * Food hygiene | * Observation * Case studies * Practicals * Oral * Third party report |
| 1. Prepare microbial enzymes | * Definition of terms * Identification and use of PPEs * Method of media preparation * Isolation of microbial organisms * Inoculation of microbial organisms. * Enzyme purification | * Written tests * Observation * Practicals * Oral questioning * Third party report |
| 1. Perform food tests | * Definition of terms * Identification and use of PPEs * Methods of food testing * Identify appropriate food testing equipment’s * Sampling techniques * Validating and recording of results | * Written tests * Observation * Practical * Oral questions * Third party report |
| 1. Preserve processed food | * Methods of food preservation * Types of food preservative * Methods of storage * Management of storage conditions * Labelling and packaging | * Written tests * Observation * Oral questions * Third party report |

**Suggested Methods of Instructions:**

* Direct instruction
* Project
* Case studies
* Field trips/site visits
* Group discussions
* Demonstration by trainer
* Practicals
* Computer Aided Learning (CAL)
* Relevant video shows

**List of Recommended Resources**

* Statutory regulations
* Computer
* Internet connectivity
* Flip charts
* Journals
* Biotechnology laboratory

# BIOTECHNOLOGY LABORATORY MAINTAINANCE

**UNIT CODE:** MED/CU/BT/CR/07/5/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Maintain biotechnology laboratory

**Duration of Unit:** 80Hours

**Unit Description**

This unit specifies the competencies required in maintaining biotechnology laboratory. It involves Collecting laboratory specimens and samples, preparing laboratory experiments, maintaining laboratory equipment, collecting and recording test data, keeping an accurate inventory records and maintaining a safe work environment.

**Summary of Learning Outcomes**

1. Collect specimens and samples
2. Prepare laboratory experiments
3. Maintain laboratory equipment
4. Collect and record test data
5. Keep accurate inventory records
6. Maintain a safe work environment

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Collect laboratory specimens and samples | * + Laboratory safety rules   + Definition of terms   + Safety precautions when handling specimens   + Types of specimens/samples   + Sample collection protocols and regulation   + Methods of maintaining integrity of samples   + Labelling and registration of samples   + Storage of samples | * Observation * Case studies * Oral questions * Practicals * Third party report |
| 1. Prepare laboratory experiments | * + Definition of terms * Identification and use of PPEs * Laboratory safety rules   + Safety precautions when preparing experiments * Standard laboratory procedures and manuals * Sorting and labelling of samples * Types of reagents and their uses * Making accurate observations * Methods of laboratory waste disposal | * Written tests * Observation * Practicals * Oral questioning * Third party report |
| 1. Maintain laboratory equipment | * + Definition of terms * Identification and use of PPEs * Setting up of test equipment * Handling and using different types of equipment’s * Methods of trouble shooting * Calibration techniques for different equipment * Routine maintenance of equipment * Performance checks | * Written tests * Observation * Practical * Oral questions * Third party report |
| 1. Collect and Record Test data | * + Definition of terms * Identification and use of PPEs * Data collections * Making observations * Data entry * Data verification * Communication of results * Interpretation and inferencing of results | * Written tests * Observation * Practicals * Oral questions * Third party report |
| 1. **Keep accurate inventory records** | * Definition of terms * Inventory management * Methods of filling laboratory results * Ethical standards in retrieval and use of laboratory results | * Written tests * Observation * Practicals * Oral questions * Third party report |
| 1. Maintain a safe work environment | * + Definition of terms * Identification and use of PPEs * Occupational safety and health procedures * Waste management * Waste disposal * Maintenance of laboratory equipment | * Written tests * Observation * Oral questions * Practicals * Third party report |

**Suggested Methods of Delivery:**

* Direct instruction
* Project
* Field trips/site visits
* Demonstration by trainer
* Experimentation
* Assignments

**List of Recommended Resources**

* Relevant software for data analysis
* Internet connectivity
* computers
* Projectors
* Stationeries
* Charts with presentations of data
* Relevant videos