

**REPUBLIC OF KENYA**

**COMPETENCY BASED CURRICULUM**

**FOR**

**ENVIRONMENTAL SCIENCE**

**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 Kenya’s development blue print and sustainable development goals.

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

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

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

**PRINCIPAL SECRETARY, VOCATIONAL AND TECHNICAL TRAINING**

**MINISTRY OF EDUCATION**

# PREFACE

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

The Technical and Vocational Education and Training Act No. 29 of 2013 on Reforming Education and Training in Kenya, emphasized the need toreform 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 Environment 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.

The curriculum is designed and organized with an outline of learning outcomes; Suggested Methods of Instruction, 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, Environment SSAC, expert workers and all those who participated in the development of this curriculum.

**CHAIRPERSON, TVET CDACC**

# ACKNOWLEDGEMENT

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

I recognize with appreciation the role of the SSAC in ensuring that competencies required by the industry are addressed in this curriculum. I also thank all stakeholders in the Environment 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 Environment sector will acquire competencies that will enable them to perform their work more efficiently.

**COUNCIL SECRETARY/CEO**

**TVET CDACC**

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# ABBREVIATIONS AND ACRONYMS

BC : Basic Competency

CDACC : Curriculum Development, Assessment and Certification Council

CPU : Central Processing Unit

CR : Core Competency

CC : Common Competency

ICT : Information Communication Technology

KCPE : Kenya Certificate of Primary Education

KCSE : Kenya Certificate of secondary Education

KNQA : Kenya National Qualifications Authority

OS : Occupational Standards

OSHA : Occupation Safety and Health Act

OSHS : Occupation Safety and Health Standards

PC : Personal Computer

PPE : Personal Protective Equipment

SOPs : Standard Operating Procedures

SSAC : Sector Skills Advisory Committee

TVET : Technical and Vocational Education and Training

ENV : Environment

SCI : Science

UNFCC : United nations Framework Convention on climate change

GPS : Global Positioning System

# KEY TO UNIT CODE

**ENV/ CU/ SCI/ BC /01 /6/A**

Industry or sector

Curriculum

Occupational area

Type of Unit

Unit number

Competency level

Version Control

# COURSE OVERVIEW

This course consists of competencies required by an environmental technician to carry out ecological monitoring and assessment, environmental analytical techniques, plant and animal taxonomy, environmental pollution and waste management, environmental microbiology, environmental information systems, principles of environmental toxicology, environmental impact assessment and environmental economics

It consists of the following units of learning:

**BASIC UNITS OF LEARNING**

|  |  |  |  |
| --- | --- | --- | --- |
| **UNIT CODE** | **UNIT OF LEARNING** | **DURATION IN HRS** | **CREDIT FACTORS** |
| ENV/CU/SCI/BC/01/6/A | Communication skills | 40 | 4 |
| ENV/CU/SCI/BC/02/6/A | Numeracy | 60 | 6 |
| ENV/CU/SCI/BC/03/6/A | Digital literacy | 60 | 6 |
| ENV/CU/SCI/BC/04/6/A | Entrepreneurship | 100 | 10 |
| ENV/CU/SCI/BC/05/6/A | Employability skills | 80 | 8 |
| ENV/CU/SCI/BC/06/6/A | Occupational safety and health practices | 40 | 4 |
|  | **TOTAL** | **380** | **38** |

**COMMON UNITS OF LEARNING**

|  |  |  |  |
| --- | --- | --- | --- |
| **UNIT CODE** | **UNIT OF LEARNING** | **DURATION IN HRS** | **CREDIT FACTORS** |
| ENV/CU/SCI/CC/01/6/A | Research project | 180 | 18 |
| ENV/CU/SCI/CC/02/6/A | Climate change and global warming | 60 | 6 |
| ENV/CU/SCI/CC/03/6/A | Resource planning and management | 60 | 6 |
| ENV/CU/SCI/CC/04/6/A | Environmental laboratory practices | 60 | 6 |
| ENV/CU/SCI/CC/05/6/A | Basic Principles of Environment | 90 | 9 |
| ENV/CU/SCI/CC/06/6/A | Environmental impact assessment | 90 | 9 |
|  | **TOTAL** | **540** | **54** |

**CORE UNITS OF LEARNING**

|  |  |  |  |
| --- | --- | --- | --- |
| **UNIT CODE** | **UNIT OF LEARNING** | **DURATION IN HRS** | **CREDIT FACTORS** |
| ENV/CU/SCI/CR/01/6/A | Ecological monitoring and assessment | 120 | 12 |
| ENV/CU/SCI/CR/02/6/A | Environmental analytical techniques | 230 | 23 |
| ENV/CU/SCI/CR/03/6/A | Plant and animal taxonomy | 100 | 10 |
| ENV/CU/SCI/CR/04/6/A | Environmental pollution and waste management | 120 | 12 |
| ENV/CU/SCI/CR/05/6/A | Environmental microbiology | 80 | 8 |
| ENV/CU/SCI/CR/06/6/A | Environmental information systems | 100 | 10 |
| ENV/CU/SCI/CR/07/6/A | Principles of environmental toxicology | 100 | 10 |
| ENV/CU/SCI/CR/08/6/A | Environmental economics | 150 | 15 |
|  | Industrial attachment | 480 | 48 |
|  | TOTAL | 1480 | 148 |
|  | **GRAND TOTAL** | 2400 | 240 |

The total duration of the course is **2400** hours which include 480 hours of industrial attachment.

**Entry Requirements**

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

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

**Or**

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

**Industrial attachment**

An individual enrolled in this course will be required to undergo an attachment for a period of three months. An individual enrolled in one of the core units of learning will be required to undergo a one month’s attachment.

**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: internally and externally. Internal assessment is continuous and is conducted by the trainer who is monitored by an accredited internal verifier while external assessment is the responsibility of TVET CDACC.

**Certification**

A candidate will be issued with a Certificate of Competency for each core unit of competency. To attain the qualification Level 6 in Environmental Science, the candidate must demonstrate competence in all the units of competency as given in qualification pack. These certificates will be issued by TVET CDACC in conjunction with training provider.

# BASIC UNITS OF LEARNING

# COMMUNICATION SKILLS

**UNIT CODE:** ENV/CU/SCI/BC/01/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Communication Skills

**Duration of Unit:** 40 hours

**Unit Description**

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

**Summary of Learning Outcomes**

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

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

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

**Suggested Methods of Instruction**

* Discussion
* Role playing
* Simulation
* Direct instruction

**Recommended Resources**

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

# NUMERACY SKILLS

**UNIT CODE:** ENV/CU/SCI/BC/02/6/A

**Relationship to Occupational Standards**

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

**Duration of Unit:** 60 hours

**Unit Description**

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

**Summary of Learning Outcomes**

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

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

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

**Suggested Methods of Instruction**

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

**Recommended Resources**

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

# DIGITAL LITERACY

**UNIT CODE:** ENV/CU/SCI/BC/03/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Digital Literacy

**Duration of Unit:** 60 hours

**Unit Description**

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

**Summary of Learning Outcomes**

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

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

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

**Suggested Methods of Instruction**

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

**Recommended Resources**

* Computers
* Printers
* Storage devices
* Internet access

# ENTREPRENEURIAL SKILLS

**UNIT CODE:** ENV/CU/SCI/BC/04/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Entrepreneurial Skills

**Duration of unit:** 100 hours

**Unit Description**

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

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Methods of Assessment** |
| 1. Demonstrate knowledge of entrepreneurship and self-employment | * Importance of self-employment * Requirements for entry into self-employment * Role of an Entrepreneur in business * Contributions of Entrepreneurs to National development * Entrepreneurship culture in Kenya * Born or made entrepreneurs | * Individual/group assignments * Projects * Written tests * Oral questions * Third party report |
| 1. Identify entrepreneurship opportunities | * Business ideas and opportunities * Sources of business ideas * Business life cycle * Legal aspects of business * Assessment of product demand * Business environment * Factors to consider when evaluating business environment * Technology in business | * Individual/group assignments * Projects * Written tests * Oral questions * Third party report * Interviews |
| 1. Create entrepreneurial awareness | * Forms of businesses * Sources of business finance * Factors in selecting source of business finance * Governing policies on Small Scale Enterprises (SSEs) * Problems of starting and operating SSEs | * Individual/group assignments * Projects * Written tests * Oral questions * Third party report * Interviews |
| 1. Apply entrepreneurial motivation | * Internal and external motivation * Motivational theories * Self-assessment * Entrepreneurial orientation * Effective communications in entrepreneurship * Principles of communication * Entrepreneurial motivation | * Case studies * Individual/group assignments * Projects * Written tests * Oral questions * Third party report * Interviews |
| 1. Develop business innovative strategies | * Innovation in business * Small business Strategic Plan * Creativity in business development * Linkages with other entrepreneurs * ICT in business growth and development | * Case studies * Individual/group assignments * Projects * Written tests * Oral questions * Third party report * Interviews |
| 6. Develop Business Plan | * Business description * Marketing plan * Organizational/Management * plan * Production/operation plan * Financial plan * Executive summary * Presentation of Business Plan | * Case studies * Individual/group assignments * Projects * Written tests * Oral questions * Third party report * Interviews |

**Suggested Methods of Instruction**

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

**Recommended Resources**

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

# EMPLOYABILITY SKILLS

**UNIT CODE:** ENV/CU/SCI/BC/05/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Employability Skills

**Duration of Unit:** 80 hours

**Unit Description**

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

**Summary of Learning Outcomes**

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

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

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

**Suggested Methods of Instruction**

1. Demonstrations
2. Simulation/Role play
3. Group Discussion
4. Presentations
5. Assignments
6. Q&A

**Recommended Resources**

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

# ENVIRONMENTAL LITERACY

**UNIT CODE**:ENV/CU/SCI/BC/06/6/A

**Relationship to Occupational Standards**:

This unit addresses the Unit of Competency : Demonstrate Environmental Literacy

**Duration of Unit:** 40 hours

**Unit Description**

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

**Summary of Learning Outcomes**

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

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

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

**Suggested Methods of Instruction**

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

**Recommended Resources**

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

# OCCUPATIONAL SAFETY AND HEALTH PRACTICES

**UNIT CODE:** ENV/CU/SCI/BC/07/6/A

**Relationship to Occupational Standards**

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

**Duration of Unit:** 40 hours

**Unit Description**

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

**Summary of Learning Outcomes**

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

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Methods of Assessment** |
| 1. Identify workplace hazards and risks | * Identification of hazards in the workplace and/or the indicators of their presence * Evaluation and/or work environment measurements of OSH hazards/risk existing in the workplace * Gathering of OSH issues and/or concerns | * Oral questions * Written tests * Portfolio of evidence * Third party report |
| 1. Control OSH hazards | * Prevention and control measures e.g. use of PPE * Risk assessment * Contingency measures | * Oral questions * Written tests * Portfolio of evidence * Third party report |
| 1. Implement OSH   programs | * Company OSH program, evaluation and review * Implementation of OSH programs * Training of team members and advice on OSH standards and procedures * Implementation of procedures for maintaining OSH-related records | * Oral questions * Written tests * Portfolio of evidence * Third party report |

**Suggested Methods of Instruction**

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

**Recommended Resources**

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

# COMMON UNITS OF LEARNING

# RESEARCH PROJECT

**UNIT CODE:** ENV/CU/SCI/CC/01/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Conduct project research

**Duration of Unit:**  180 hours

**Unit Description**

This unit describes the competencies required to prepare project proposal, collect data, analyse data and prepare project report.

**Summary of Learning Outcomes**

1. Prepare project proposal
2. Collect data
3. Analyze data
4. Prepare project report

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Methods of Assessment** |
| * + 1. Prepare project proposal | * Meaning and importance of research * Research methods * Value of research to environmental studies * Types of research methodologies * Importance of a research project proposal * Factors to consider in selecting a research project * Format of project proposal * Contents of a project proposal * Formulation of a research project objectives * Literature review * Referencing | * Observation * Oral questioning * Projects |
| * + 1. Collect data | * Types of data * Sources of data * Methods of data collection * Advantages and disadvantages of data collection methods * Data collection instruments * Data collection procedures * Sampling techniques * Data collation | * Observation * Oral questioning * Written tests * Projects |
| * + 1. Analyze data | * Data management   + Data tabulation   + Data coding   + Data analysis   + Data interpretation * Data processing   + Software e.g. SPSS, GIS, STATA, Excel. * Data presentation | * Observation * Oral questioning * Written tests * Projects * Practicals |
| * + 1. Prepare project report | * Importance of a research project report * Format of project research report * Contents of a project report | * Observation * Oral questioning * Project report |

**Suggested Methods of Instruction**

* Lectures
* Group discussions
* Demonstration by trainer
* Exercises by trainee

**Recommended Resources**

* Data
* Computer
* Stationery
* Internet

# CLIMATE CHANGE AND GLOBAL WARMING

**UNIT CODE:** ENV/CU/SCI/CC/02/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Manage climate change and global warming

**Duration of Unit:**  60 hours

**Unit Description**

This unit describes the competencies required to manage effects of climate change and global warming, apply responses, mitigation and adaptation strategies, apply international policies and interventions and sensitize community.

**Summary of Learning Outcomes**

1. Manage effects of climate change and global warming
2. Apply responses, mitigation and adaptation strategies to climate change.
3. Apply international policies and interventions

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Methods of Assessment** |
| * + 1. Manage effects of climate change and global warming | * + Meaning of climate change and global warming   + Causes of global warming   + Effects of global warming and climate change   + Greenhouse gases   + Greenhouse effect   + Indicators of global warming   + Climate change modelling | * Observation * Oral questioning * Written tests * Projects practical assessments |
| * + 1. Apply responses, mitigation and adaptation strategies to climate change. | * Meaning of adaptation and mitigation * Adaptation and mitigation measures to climate change * Resource efficiency mechanisms for resolving climate change issues * Sustainable development practices * Alternative sources of energy * Impacts of climate change * Community sensitization and coping strategies | * Observation * Oral questioning * Written tests * Projects practical assessments |
| * + 1. Apply international policies and interventions | * Carbon trading * Conference of parties (COP) * Local and International policies on climate change * Functions of the national climate change council * Policies of UNFCC (United nations Framework Convention on climate change) * Relationship between climate and development * Climate financing mechanisms * Emerging issues on Climate change | * Observation * Oral questioning * Written tests * Projects practical assessments |

**Suggested Methods of Instruction**

* Lectures
* Group discussions
* Demonstration by trainer
* Exercises by trainee
* Educational trips and forums
* Conferences

**Recommended Resources**

* Data
* Computer
* Stationery
* Projectors
* Internet

# RESOURCE PLANNING AND MANAGEMENT

**UNIT CODE:** ENV/CU/SCI/CC/03/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Perform resource planning and management

**Duration of Unit:**  60 hours

**Unit Description**

This unit describes the competencies required to perform environmental planning, manage land resources, manage water resources, manage marine and coastal resources and manage ASALs.

**Summary of Learning Outcomes**

* + - 1. Perform environmental planning
      2. Manage land resources
      3. Manage water resources
      4. Manage marine and coastal resources
      5. Manage ASALs

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Methods of Assessment** |
| * + 1. Perform environmental planning | * Environmental resource * Environmental assessment surveys * The environmental plan * Budget * Relevant stakeholders. | * Observation * Oral questioning * Written tests * Projects practical assessments |
| * + 1. Manage land resources | * Types of land resources   + Forests   + Rangelands   + Wildlife   + Soils   + Vegetation   + ASALs   + Minerals * Biodiversity * Sustainable resource management strategies * Resource management plan * Natural resource regulations * Sustainable agriculture * Emerging issues | * Observation * Oral questioning * Written tests * Projects practical assessments |
| * + 1. Manage water resources | * Types of water resources * Water pollution * Water catchments * Water resource conflicts and resolutions * Principles of integrated water resource management * Policies/regulations on water resources * Wetland biodiversity * Wastewater management | * Observation * Oral questioning * Written tests * Projects practical assessments |
| * + 1. Manage marine and coastal resources | * Types of marine and coastal resources * Marine protected areas (MPAs) * Principles of integrated coastal zone management (ICZM) * Marine ecology * Marine pollution * Marine resource policies and regulations * Transboundary resource conflicts * Emerging issues | * Observation * Oral questioning * Written tests * Projects practical assessments |

**Suggested Methods of Instruction**

* Lectures
* Group discussions
* Demonstration by trainer
* Exercises by trainee
* Trips

**Recommended Resources**

* Data
* Computer
* Stationery
* Internet

# ENVIRONMENTAL LABORATORY PRACTICES

**UNIT CODE:** ENV/CU/SCI/CC/04/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Perform environmental laboratory practices

**Duration of Unit:**  60 hours

**Unit Description**

This unit describes the competencies required to develop laboratory layout, maintain lab safety, administer first aid, install laboratory equipment, administer lab practicals, handle lab animals and plants, produce photographs and manage laboratory records.

**Summary of Learning Outcomes**

* + - 1. Develop laboratory layout
      2. Maintain lab safety
      3. Administer first aid
      4. Install laboratory equipment
      5. Administer lab practicals
      6. Handle lab animals and plants
      7. Produce photographs
      8. Manage laboratory records

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Methods of Assessment** |
| 1. Develop laboratory layout | * Importance of laboratories in environmental studies * Types of laboratories * Laboratory design * Laboratory fittings | * Observation * Oral questioning * Written tests |
| 1. Maintain lab safety | * Sources of danger in the laboratory * Safety design features in the laboratory * Prevention of danger in the laboratory * Good housekeeping | * Observation * Oral questioning * Written tests * Practical assessments |
| 1. Administer first aid | * Importance of first aid * Contents of first aid box * Injuries and their treatment * Poisoning and their treatment | * Observation * Oral questioning * Written tests * Practicals * Role play |
| 1. Install laboratory equipment | * Lab equipment   + Balances   + Mercury barometers   + Galvanometer   + Glass bowers   + Heavy equipment   + Laboratory stills   + Spectrographic equipment   + Bunsen burner   + Fire extinguishers * Effects of vibration on equipment * Method of overcoming vibrations | * Observation * Oral questioning * Practical assessments |
| 1. Administer lab practicals | * Types of reagents * Handling lab reagents * Preparation of solutions * Storage of reagents * Good housekeeping * Preparation of lab reports * Role of supervisor in lab practicals | * Observation * Oral questioning * Written tests * Projects practical assessments |
| 1. Handle lab animals and plants | * Good housekeeping * Animal breeding * Inoculation methods * Post mortem * Disposal of lab specimen | * Observation * Oral questioning * Practical assessments |
| 1. Produce photographs | * Camera optics * Structure and working principles of camera * Film processing procedure * Role of lighting * Photo taking * Printing procedure * Labelling * Design features of a dark room * Working of protection equipment * Dark room techniques * Photomicrography * Use of filters | * Observation * Oral questioning * Practical assessments |
| 1. Manage laboratory records | * Preparation of organization structure of the lab * Attendance records * Preparation of lab reports * Storage of lab documents | * Observation * Oral questioning * Practical assessments |

**Suggested Methods of Instruction**

* Lectures
* Group discussions
* Demonstration by trainer
* Exercises by trainee

**Recommended Resources**

* Laboratory
* Lab equipment
* Reagents / specimen
* First aid kits
* Data
* Computer
* Stationery
* Internet

# BASIC PRINCIPLES OF ENVIRONMENT

**UNIT CODE**:ENV/CU/SCI/CC/05/6/A

**Relationship to Occupational Standards**:

This unit addresses the unit standard: **Apply basic principles of environment**

**Duration of Unit:** 90 hours

**Unit Description**

This unit describes the competencies required to apply Principles of ecology, manage environmental resources, manage pollution and wastes, demonstrate sustainable resource use, apply environmental legislations and implement and monitor environmental programs

**Summary of Learning Outcomes**

1. Apply principles of ecology
2. manage environmental resources
3. manage pollution and wastes
4. demonstrate sustainable resource use
5. apply environmental legislations
6. implement and monitor environmental programs

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Methods of Assessment** |
| 1. Apply principles of ecology | * Meaning of environment * Components of environment * Ecological concepts * Bio-geochemical cycles * Interactions in ecosystems:   + Species interaction   + Ecological niche   + Plant distribution   + Energy flow in the ecosystem   + Carrying capacity   + Ecological succession * Types of ecosystems * Ecosystem degradation * Biogeography and climate of East Africa * Conservation strategies * Contemporary environmental issues | * Written questions * Oral questions * Observation of work procedures * Role play |
| 1. Manage environmental pollution and wastes | * Types of pollution * Sources of pollution * Environmental pollution control measures * Types of wastes * Procedures of waste management * Methods for waste management * Different types of environmental pollution * Pollution prevention, minimization and control * Principles of waste management * Effects of pollution on the environment | * Written questions * Oral questions * Observation of work procedures * Role play |
| 1. Demonstrate sustainable resource use | * Types of resources * Uses of resources * Management of resources * Monitoring of resources * Techniques in measuring current usage of resources * Methods for minimizing wastage * Collection of information on environmental and resource efficiency systems and procedures * Resource conservation plans | * Written questions * Oral questions * Observation of work procedures * Role play |
| 1. Apply environmental legislations | * Environmental issues/concerns * Environmental legislations * Multilateral Environmental Agreements * Environmental management practices * Law enforcement mechanisms * Environmental offences and penalties * Policy formulation and review | * Written questions * Oral questions * Observation of work procedures |
| 1. Implement and monitor environmental programs | * Community needs assessment * Resource mobilization * Stakeholder analysis * Project implementation and monitoring plan * Resolving problems /constraints encountered * Report writing * Monitoring and reporting of environmental incidents | * Written questions * Oral questions * Observation of work procedures * Role play |
| 1. Develop resource Conservation plans | * Determination of efficiency of use/conversion of resources * Causes of low efficiency of use of resources * Plans for increasing the efficiency of resource use | * Written tests * Oral questions * Practical test * Observation |

**Suggested Methods of Instruction**

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

**Recommended Resources**

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

# ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

**UNIT CODE:** ENV/CU/SCI/CC/06/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Assess environmental impact

**Duration of Unit:**  90 hours

**Unit Description**

This unit describes the competencies required to conduct environmental impact assessment, and prepare an environmental and social management plan, conduct a strategic environmental assessment, conduct environmental audit and design legal policy and administrative framework for EIA and EA

**Summary of Learning Outcomes**

* + - 1. Conduct Environmental Impact Assessment
      2. Prepare an environmental and social management plan
      3. Conduct a Strategic environmental assessment
      4. Conduct Environmental Audit
      5. Design legal policy and administrative framework for EIA and EA

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Methods of Assessment** |
| 1. Conduct Environmental Impact Assessment (EIA) | * Role and mandates of NEMA in managing EIA * Meaning and importance of EIA * EIA procedure * EIA methodology * Stakeholder identification and mapping * Consultation and public participation * Principles of EIA * Objectives of EIA * EIA report * Decision making * NEMA requirements for EIA * EIA regulations and policies * Selected case studies | * Observation * Oral questioning * Written tests * Case study * Projects |
| 1. Prepare an environmental and social management plan (EMP) | * Meaning and importance of EMP * Principles of EMP * Components of EMP * Preparation of environmental action plan * Monitoring and evaluation of EMP * Social impact assessment | * Observation * Oral questioning * Written tests * Case study * Projects |
| 1. Conduct Strategic environmental assessment (SEA) | * Meaning and importance of SEA * Principles of SEA * Objectives of SEA * SEA process * SEA report * Submission of SEA report | * Observation * Oral questioning * Written tests * Case study * Projects |
| 1. Conduct Environmental Audit (EA) | * Meaning and importance of EA * Types of Environmental Audits * Environmental Audit procedure * Format of EA report * Contents of EA report * EA Monitoring * Audit report * Decision making * Selected audit case studies | * Observation * Oral questioning * Written tests * Case study * Projects |
| 1. Design legal policy and administrative framework for EIA and EA | * Legal policy provisions relating to EIA and EA in Kenya * Administrative framework for EIA and EA | * Observation * Oral questioning * Written tests * Case study * Projects |

**Suggested Methods of Instruction**

* Lectures
* Group discussions
* Demonstration by trainer
* Exercises by trainee
* Visits/trips

**Recommended Resources**

* Recorders
* Cameras
* Stationery
* Internet

# CORE UNITS OF LEARNING

# ECOLOGICAL MONITORING AND ASSESSMENT

**UNIT CODE:** ENV/CU/SCI/CR/01/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Monitor and assess ecology

**Duration of Unit:**  120 hours

**Unit Description**

This unit describes the competencies required to monitor ecosystem, develop ecological monitoring program, assess ecosystem and restore and rehabilitate degraded ecological habitat

**Summary of Learning Outcomes**

* + - 1. Monitor ecosystem
      2. Develop ecological monitoring program
      3. Assess ecosystem.
      4. Restore and rehabilitate degraded ecological habitat

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Methods of Assessment** |
| 1. Monitor ecosystem | * Meaning of ecosystem * Importance of ecological monitoring * Application of ecological monitoring and assessment in environmental management * Types of ecosystems * Ecological monitoring techniques * Environmental monitoring parameters | * Observation * Oral questioning * Written tests * Projects practical assessments |
| 1. Develop ecological monitoring program | * Stages involved in environmental monitoring * Determination of monitoring objects and variables * Sampling strategies * Use of ecological monitoring tools and equipment * Application of ecological monitoring techniques * Emerging technologies | * Observation * Oral questioning * Written tests * Projects practical assessments |
| 1. Assess ecosystem. | * Ecological assessment techniques * Characteristics of effective indicators * Procedures in developing ecological monitoring indicators * Types of ecological indicators * Properties of ecological indicators | * Observation * Oral questioning * Written tests * Projects practical assessments |
| 1. Restore and rehabilitate degraded ecological habitat | * Determination of restoration and rehabilitation objectives * Development of restoration and rehabilitation plan * Design of Restoration and rehabilitation monitoring plan * Implementation of restoration and rehabilitation plan | * Observation * Oral questioning * Written tests * Projects |

**Suggested Methods of Instruction**

* Lectures
* Group discussions
* Demonstration by trainer
* Exercises by trainee
* Trips

**Recommended Resources**

* GNSS receivers
* Camera
* Maps
* Laboratory
* Data
* Computer
* Stationery
* Internet

# ENVIRONMENTAL ANALYTICAL TECHNIQUES

**UNIT CODE:** ENV/CU/SCI/CR/02/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Carry out environmental analytical techniques

**Duration of Unit:**  230 hours

**Unit Description**

This unit describes the competencies required to perform basic lab analysis, perform biochemical techniques, carry out titrimetric analysis, carry out gravimetric analysis, carry out complex titrations, apply thermochemistry and perform instrumentation analysis

**Summary of Learning Outcomes**

* + - 1. Perform basic lab analysis
      2. Perform biochemical techniques
      3. Carry out titrimetric analysis
      4. Carry out gravimetric analysis
      5. Carry out complex titrations
      6. Apply thermochemistry
      7. Perform instrumentation analysis

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Methods of Assessment** |
| 1. Perform basic lab analysis | * Importance and purpose of lab analysis * Filtration technique * Decantation * Heating and cooling techniques * Distillation technique * Recrystallization and sublimation * Solvent extraction * Acid based titrations * Chromatography techniques | * Observation * Oral questioning * Written tests * Projects practical assessments |
| 1. Perform biochemical techniques | * Separation of amino acids * Determination of protein content * Analysis of fats and oils * Determination of presence of Vitamins * Separation techniques | * Observation * Oral questioning * Written tests * Practicals |
| 1. Carry out titrimetric analysis | * Meaning and purpose of titrimetric analysis * Preparation of redox solutions * Standardization of redox solutions * Redox titrations | * Observation * Oral questioning * Written tests * Practicals |
| 1. Carry out complex titrations | * Meaning of complex solutions * Preparation of complex solutions * Stability of complexes * Complex titrations * Titration of mixtures | * Observation * Oral questioning * Written tests * Projects practicals |
| 1. Carry out gravimetric analysis | * Meaning of gravimetric analysis * Principles of gravimetric analysis * Factors affecting separation of metals and compounds * Theory of precipitation * Types of precipitates * Determination of solubility of salts * Preparation of pure precipitates * Crystalline precipitates * Gravimetric calculations | * Observation * Oral questioning * Written tests * Projects practical assessments |
| 1. Apply thermochemistry | * Types of heat reaction   + Exothermic   + Endothermic   + Heats of formation   + Combustion   + Solution   + Neutralization * Laws of conservation of energy * Enthalpy changes * Calorimetric method | * Observation * Oral questioning * Written tests * Projects practical assessments |
| 1. Perform instrumentation analysis | * Spectrophotometer * Flame photometer * pH meter * Chromatographs * Balances * Conductivity meters | * Observation * Oral questioning * Written tests * Projects practical assessments |

**Suggested Methods of Instruction**

* Lectures
* Group discussions
* Demonstration by trainer
* Exercises by trainee

**Recommended Resources**

* Laboratory
* Reagents and solutions
* Instruments
* Lab equipment
* Data
* Computer
* Stationery
* Internet

# PLANT AND ANIMAL TAXONOMY

**UNIT CODE:** ENV/CU/SCI/CR/03/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply principles of plant and animal taxonomy

**Duration of Unit:**  100 hours

**Unit Description**

This unit describes the competencies required to classify and name plants and animals, collect and preserve plants and animals, conserve and manage plant and animal species

**Summary of Learning Outcomes**

* + - 1. Classify and name plant and animal species
      2. Collect and preserve plant and animal specimen
      3. Conserve plant and animal species in ecosystem
      4. Manage plant and animal species

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | * **Content** | **Methods of Assessment** |
| 1. Classify and name plant and animal species | * Meaning and importance of classification * Taxonomy and taxonomic units of classification * Binomial nomenclature * 5 kingdom system of classification   + Characteristics * Identification techniques * Dichotomous key | * Observation * Oral questioning * Written tests * Projects * Practical assessments |
| 1. Collect and preserve plant and animal specimen | * Museum and herbarium techniques * Methods of collecting plant and animal specimen * Equipment for collection and preservation * Preservation of plant specimen * Preservation of animal specimen | * Observation * Oral questioning * Written tests * Projects practical assessments |
| 1. Conserve plant and animal species in ecosystem | * Meaning of conservation * Importance and purpose of conservation * Types of conservation   + Ex-situ (e.g. gene bank and botanical gardens)   + In-situ * Approaches used in conservation of plant and animal species * Conventions and treaties in conservation of plant and animal species in the ecosystem * Bioprospecting and biodiversity conservation | * Observation * Oral questioning * Written tests * Practicals |
| 1. Manage plant and animal species | * Economic/ecological values of plants and animals * Management of pests, diseases and weeds * Invasive species * Role of native and exotic species * Endangered plants and animals * Plant and animal Protection Acts | * Observation * Oral questioning * Written tests * Projects practical assessments |

**Suggested Methods of Instruction**

* Lectures
* Group discussions
* Demonstration by trainer
* Exercises by trainee
* Photos and videos

**Recommended Resources**

* Laboratory
* Cameras
* Data
* Computer
* Stationery
* Internet

# ENVIRONMENTAL POLLUTION AND WASTE MANAGEMENT

**UNIT CODE:** ENV/CU/SCI/CR/04/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: manage environmental pollution and waste

**Duration of Unit:**  120 hours

**Unit Description**

This unit describes the competencies required to classify environmental pollutants, control air, water, soil and noise pollution and sensitize community on the impacts of pollution on the environment, manage wastewater, manage solid waste, manage hazardous waste, manage e-waste and sensitize community

**Summary of Learning Outcomes**

* + - 1. Classify environmental pollutants
      2. Control air pollution
      3. Control water pollution
      4. Control soil pollution
      5. Control noise pollution
      6. Manage wastewater
      7. Manage solid waste
      8. Manage hazardous waste
      9. Manage e-waste
      10. Sensitize community

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Methods of Assessment** |
| 1. Classify environmental pollutants | * Meaning of pollution * Effects of pollution to the environment * Types of pollution * Types of pollutants | * Observation * Oral questioning * Written tests * Projects practical assessments |
| 1. Control air pollution | * Types of air pollutants * Sources of air pollution * Dispersion of pollutants * Gaseous air pollutants * Inorganic air pollutants * Analysis of air samples * Smog forming emissions * Effects of air pollution to the environment * Air pollution trends   + Ozone depletion   + Acid rain   + Global warming and climate change | * Observation * Oral questioning * Written tests * Projects practical assessments |
| 1. Control water pollution | * Nature and type of water pollution * Types of water pollutants * BOD, COD, acidity, alkalinity (pH), salinity, conductivity and turbidity. * Harmful effects of pollutants to water * Water pollution control methods * Water pollution trends   + Water hyacinth   + Eutrophication   + Siltation   + Bio-magnification   + Bio-accumulation | * Observation * Oral questioning * Written tests * Practical assessments |
| 1. Control soil pollution | * Types of soil pollutants * Sources of soil pollution * Soil tests for determination of pollutants * Treatment of polluted soil * Effects of pollutants to the soil * Soil pollution control measures * Environmental regulations (EMCA (Amendment) 2015) | * Observation * Oral questioning * Written tests * Practical assessments |
| 1. Control noise pollution | * Sources of noise pollution * Noise meters * Determination of noise pollution level * Noise pollution control measures * Noise and vibrations regulations (EMCA (Amendment) 2015) | * Observation * Oral questioning * Written tests * Projects practical assessments |
| 1. Manage wastewater | * Meaning and importance of waste management * Types of wastes * Sources of wastewater * Types of wastewater * Wastewater treatment process * Wastewater recycling, reuse and reclamation | * Observation * Oral questioning * Written tests * Projects practical assessments |
| 1. Manage solid waste | * Types of solid waste * Quantities and characteristics of solid waste * Procedures of solid waste management   + Source identification   + Sorting/ segregation   + Collection   + Transportation   + Disposal * Methods of solid waste volume reduction * The 7Rs principle   + Reuse   + Recycle   + Reduce   + Repair   + Rethink   + Refill   + Refuse | * Observation * Oral questioning * Written tests * Projects practical assessments |
| 1. Manage hazardous waste | * Meaning of hazardous wastes * Types and characteristics of hazardous wastes * Impacts of hazardous waste to the environment * Hazardous waste processing, handling and disposal * Transportation of hazardous waste * Resource recovery alternatives * Hazardous waste management facilities * Regulations on hazardous waste management | * Observation * Oral questioning * Written tests * Projects practical assessments |
| 1. Manage e-waste | * Types of e-wastes * E-waste management process * The 7Rs principles * Waste management regulations, WEEE (waste, electrical and electronic equipment) directives and guidelines | * Observation * Oral questioning * Written tests * Projects practical assessments |
| 1. Sensitize community | * Importance of community sensitization on pollution and waste management. * Community mobilization and sensitization procedures * Waste as a resource * Waste management policies. (EMCA, amendment 2015) | * Observation * Oral questioning * Written tests * Projects |

**Suggested Methods of Instruction**

* Lectures
* Group discussions
* Demonstration by trainer
* Exercises by trainee

**Recommended Resources**

* Monitoring Equipment
* Laboratory
* Data
* Computer
* Stationery
* Internet

# ENVIRONMENTAL MICROBIOLOGY

**UNIT CODE:** ENV/CU/SCI/CR/05/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Perform environmental microbiological techniques

**Duration of Unit:**  80 hours

**Unit Description**

This unit describes the competencies required to classify micro-organisms, prepare media, sterilize equipment, culture micro-organisms, prepare specimen for microscopy and perform sensitivity tests and manage microbial resources

**Summary of Learning Outcomes**

* + - 1. Classify micro-organisms
      2. Prepare media
      3. Sterilize equipment
      4. Culture micro-organisms
      5. Prepare specimen for microscopy
      6. Perform sensitivity tests
      7. Manage microbial resources

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Methods of Assessment** |
| 1. Classify micro-organisms | * Meaning and purpose of environmental microbiology * Role of micro-organisms in the environment * Classification of microorganisms   + Bacteria   + Yeast and Moulds   + Protozoa   + Algae   + Viruses * Structural characteristics of major groups of micro-organisms * Micro-organism and biotic interactions | * Observation * Oral questioning * Written tests * Projects practical assessments |
| 1. Prepare media | * Meaning of media * Importance of media * Composition of media * Types of media * Media preparation techniques | * Observation * Oral questioning * Written tests * Projects practical assessments |
| 1. Sterilize equipment | * Importance of sterilization * Methods of sterilization * Factors influencing sterilization * Sterility testing | * Observation * Oral questioning * Written tests * Projects practical assessments |
| 1. Culture micro-organisms | * Meaning and purpose of microbial culture * Isolation techniques * Cultivation requirements * Factors that control growth of micro-organisms * Growth features * Preservation of micro-organisms * Growth curve of micro-organisms | * Observation * Oral questioning * Written tests * Projects practical assessments |
| 1. Prepare specimen for microscopy | * Types of microscopes * Parts of a microscope * Microscope handling and usage * Specimen preparation * Inoculation methods * Meaning of staining * Purpose of staining * Staining techniques   + Simple stain   + Grams stain   + Bacterial spore stain   + Capsules stain   + Lactophenol in cotton blue stain | * Observation * Oral questioning * Written tests * Projects practical assessments |
| 1. Perform sensitivity tests | * Meaning and purpose of sensitivity tests * Classes of anti-microbial drugs * Mode of action * Resistance to anti-microbial drugs * Procedures for sensitivity tests | * Observation * Oral questioning * Written tests * Projects practical assessments |
| 1. Manage microbial resources | * Role of micro-organisms in food production * Role of microorganisms in industrial processes * Biodegradation * Bioremediation * Role of micro-organism in energy production | * Observation * Oral questioning * Written tests * Projects practical assessments |

**Suggested Methods of Instruction**

* Lectures
* Group discussions
* Demonstration by trainer
* Exercises by trainee

**Recommended Resources**

* Microscope
* Solutions
* Lab equipment
* Laboratory
* Data
* Computer
* Stationery
* Internet

# ENVIRONMENTAL INFORMATION SYSTEMS

**UNIT CODE:** ENV/CU/SCI/CR/06/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply environmental information systems

**Duration of Unit:**  100 hours

**Unit Description**

This unit describes the competencies required to apply GIS and remote sensing techniques, perform geo-graphic communication and produce geo-maps

**Summary of Learning Outcomes**

* + - 1. Apply GIS and remote sensing techniques
      2. Perform geo-graphic communication
      3. Produce geo-maps

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Methods of Assessment** |
| 1. Apply geo-graphic communication | * Meaning and importance of environmental information systems * Types of graphic communications * Advantages and disadvantages of graphic communications * Information communication systems * Computer software for GIS and remote sensing * Generation of digital models | * Observation * Oral questioning * Written tests * Practical assessments |
| 1. Apply GIS and remote sensing techniques | * Key components of GIS * Principles of GIS * Principles of remote sensing * Principles of Global Positioning System (GPS) * Types of GIS data * Types of remote sensors and platforms * Types of remote sensing * Basic steps in remote sensing * Satellite meteorology * Uses of radar systems * Images geo-referencing * Image processing * Environmental database management * Geometric properties of aerial photographs * Application of GIS and remote sensing in management of natural resources | * Observation * Oral questioning * Written tests * Practical assessments |
| 1. Produce geo-maps | * Meaning of geodatabase * Elements of a map * Purpose of digital mapping * Types of geo-maps * Generation of maps * Digital map designs and compilations * Features of the maps * Map projection * Map interpretation * Co-ordinate reference systems | * Observation * Oral questioning * Written tests * Projects * practical assessments |

**Suggested Methods of Instruction**

* Lectures
* Group discussions
* Demonstration by trainer
* Exercises by trainee
* Visits/trips

**Recommended Resources**

* GIS lab
* Computer
* Software
* Data
* GNSS receivers
* Sensors
* Cameras
* Stationery
* Internet

# PRINCIPLES OF ENVIRONMENTAL TOXICOLOGY

**UNIT CODE:** ENV/CU/SCI/CR/07/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply principles of environmental toxicology

**Duration of Unit:**  100 hours

**Unit Description**

This unit describes the competencies required to evaluate exposure pathways, analyze environmental samples for toxicity, assess level of exposure to toxicants and perform anatomical section of lab plants and animals

**Summary of Learning Outcomes**

* + - 1. Evaluate exposure pathways
      2. Analyze environmental samples for toxicity
      3. Assess level of exposure to toxicants
      4. Perform anatomical section of lab plants and animals

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Methods of Assessment** |
| * + - 1. Evaluate exposure pathways | * Meaning and importance of environmental toxicology * Meaning of toxins * Types of environmental toxins * Biomarkers * Sources of release * Exposure medium * Exposure points * Routes of exposure * Absorption mechanisms * Distribution systems * Bio-transformations * Excretion * Bio-magnification/bioaccumulation * Safety precautions | * Observation * Oral questioning * Written tests * Projects practical assessments |
| * + - 1. Analyze environmental samples for toxicity | * Safety precautions (PPEs) * Types of toxicants * Mechanisms of toxicity * Effects of toxicants to organisms * Procedures for sample collection and handling * Heavy metal and aflatoxin analysis * Parameters tested in samples * Analysis of environmental samples * Report writing * Record keeping | * Observation * Oral questioning * Written tests * Projects practical assessments |
| * + - 1. Assess level of exposure to toxicants | * Safety precautions * Hazard identification   + Indicators of toxicity   + Side effects * Toxicity tests   + Risk characterization   + Dose-response assessment * Alternative toxicity testing methods * Exposure assessment * Variation in susceptibility   + Risk perception | * Observation * Oral questioning * Written tests * Projects practical assessments |
| * + - 1. Perform anatomical section of laboratory plants and animals | * Use of laboratory plants animals for toxicity analysis/tests * Preparation of laboratory plants and animals * Taxidermy procedures   + Dissecting   + Mounting   + Preservation * Laboratory specimen disposal * Report writing | * Observation * Oral questioning * Written tests * Projects practical assessments |

**Suggested Methods of Instruction**

* Lectures
* Group discussions
* Demonstration by trainer
* Exercises by trainee

**Recommended Resources**

* Laboratory
* Reagents and solutions
* First aid kit
* Sensors
* Cameras
* Stationery
* Internet

# ENVIRONMENTAL ECONOMICS

**UNIT CODE:** ENV/CU/SCI/CR/08/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply principles of environmental economics

**Duration of Unit:**  150 hours

**Unit Description**

This unit describes the competencies required to apply principles of environmental economics, determine prices of commodities and apply principles of international trade

**Summary of Learning Outcomes**

* + - 1. Apply principles of environmental economics
      2. Determine prices of commodities
      3. Apply principles of international trade

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Methods of Assessment** |
| 1. Apply principles of environmental economics | * Meaning and purpose of environmental economics * Economic methodology * Resource economics * Resource allocation * Categorization of resources * Valuation of environmental resource (payment of ecosystem services) * Concepts of opportunity costs, scarcity and choice * Demand analysis * Supply analysis * Cost benefit analysis * Externalities | * Oral questioning * Written tests |
| 1. Determine prices of commodities | * Determination of prices * Price determination by market forces * Price mechanism and resource allocation * Defects of price mechanisms and resource allocation * Government intervention with price mechanisms * Price allocation | * Oral questioning * Written tests |
| 1. Apply principles of international trade | * Principles of specialization and exchange between countries * Barriers to trade * Balance of payments * Advantages and disadvantages of international trade * Exchange rate systems * International economic organization | * Oral questioning * Written tests |

**Suggested Methods of Instruction**

* Lectures
* Group discussions
* Demonstration by trainer
* Exercises by trainee

**Recommended Resources**

* Calculator
* Stationery
* Internet