

**REPUBLIC OF KENYA**

**NATIONAL COMPETENCY BASED CURRICULUM**

**FOR**

**GIS TECHNOLOGY LEVEL 4**



TVET CDACC

P.O BOX 15745-00100

NAIROBI

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# FOREWORD

The provision of quality education and training is fundamental to the Government’s overall strategy for social economic development. Quality education and training will contribute to achievement of Kenya’s development blueprint, Vision 2030 and sustainable development goals.

Reforms in the education sector are necessary for the achievement of Kenya Vision 2030 and meeting the provisions of the Constitution of Kenya 2010. The education sector had to be aligned to the Constitution of Kenya 2010 and this resulted to the formulation of the Policy Framework for Reforming Education and Training (Sessional Paper No. 4 of 2016). A key feature of this policy is the radical change in the design and delivery of the TVET training. This policy document requires that training in TVET be competency based, curriculum development be industry led, certification be based on demonstration of competence and mode of delivery allows for multiple entry and exit in TVET programmes.

These reforms demand that Industry takes a leading role in curriculum development to ensure the curriculum addresses its competence needs. It is against this background that these Occupational Standards were developed for the purpose of developing a competency-based curriculum for GIS Technologist. These Occupational Standards will also be the bases for assessment of an individual for competence certification.

It is my conviction that these Occupational Standards will play a great role towards development of competent human resource for the ICT 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 in order to address the mismatch between skills acquired through training and skills needed by industry as well as increase the global competitiveness of Kenyan labour force.

The TVET Curriculum Development, Assessment and Certification Council (TVET CDACC), in conjunction with ICT Sector Skills Advisory Committee (SSAC have developed these Occupational Standards for GIS technologists. These standards will be the bases for development of competency-based curriculum for a GIS Technologist Level 4.

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

**Prof. CHARLES M. M. ONDIEKI, PhD, FIET (K), Con. EngTech.**

**CHAIRMAN, TVET CDACC**

# ACKNOWLEDGMENT

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

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

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

**Dr. LAWRENCE GUANTAI M’ITONGA, PhD**

**COUNCIL SECRETARY/CEO**

# KEY TO UNIT CODE

IT/CU/GIS/BC/01/4/A

Industry or sector

Occupational Standards

Occupational area

Type of competency

Competency number

Unit Level

Version Control

# ACRONYMS

BC : Basic Competency

CDACC : Curriculum Development, Assessment and Certification Council

CR : Core Competency

CSV : Comma Separated Value

GIS : Geographic Information System

GPS : Global Positioning System

ICT : Information Communication Technology

KML : Keyhole Markup Language

KNQA : Kenya National Qualifications Authority

OS : Occupational Standards

OSHA : Occupation Safety and Health Act

OSHS : Occupation Safety and Health Standards

PPE : Personal Protective Equipment

RDBMS : Relational Database Management System

RS : Remote Sensing

SSAC : Sector Skills Advisory Committee

TVET : Technical and Vocational Education and Training

UTM : Universal Transverse Mercator

A : Control Version

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# COURSE OVERVIEW

GIS Technology Level 4 consists of competencies that an individual must achieve to be competent. It entails; recognising the foundations of Geographical Information Systems (GISs), using and managing GIS data, visualising GIS data using maps, performing GIS data analytics, analysing terrains and images and applying GIS standards and compliance areas. This qualification consists of the following basic and core competencies:

This qualification consists of the following basic and core competencies:

**BASIC UNITS OF LEARNING**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit of Learning Code** | **Unit of Learning Title** | **Duration in Hours** | **Credit factor** |
| IT/CU/GIS/BC/01/4/A | Communication skills | 20 | 2.0 |
| IT/CU/GIS/BC/02/4/A | Numeracy skills | 25 | 2.5 |
| IT/CU/GIS/BC/03/4/A | Digital literacy | 35 | 3.5 |
| IT/CU/GIS/BC/04/4/A | Entrepreneurial skills | 60 | 6.0 |
| IT/CU/GIS/BC/05/4/A | Employability skills | 30 | 3.0 |
| IT/CU/GIS/BC/06/4/A | Environmental literacy | 20 | 2.0 |
| IT/CU/GIS/BC/07/4/A | Occupational safety and health practices | 20 | 2.0 |
| **TOTAL** | | **210** | **21.0** |

**CORE UNITS OF LEARNING**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit factor** |
| IT/CU/GIS/CC/01/4/A | Foundations of Geographical Information Systems | 80 | 8.0 |
| IT/CU/GIS/CC/02/4/A | Management of GIS Data | 100 | 10.0 |
| IT/CU/GIS/CC/03/4/A | GIS Data Visualization Using Maps | 110 | 11.0 |
| IT/CU/GIS/CC/04/4/A | GIS Data Analytics | 110 | 11.0 |
| IT/CU/GIS/CC/05/4/A | Terrains and Images Analysis | 100 | 10.0 |
| IT/CU/GIS/CC/06/4/A | GIS standards and compliance | 80 | 8.0 |
| IT/CU/GIS/CC/07/4/A | Industrial Attachment | 300 | 30.0 |
| **TOTAL** | | **880** | **88.0** |
| **GRAND TOTAL** | | **1090** | **109.0** |

The core units of learning are independent of each other and may be taken independently.

The total duration of the course is **1090** hours inclusive of industrial attachment.

**Field Attachment**

It is envisaged that the trainee will have undergone a field training and assessment with a recognized firm as a prerequisite for completion of this training course. At least 300 hours should be spent on a supervised and assessed field attachment.

**Entry Requirements**

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

1. Attained KCSE with mean grade of E

**Or**

1. Information Communication Technology (ICT) National Certificate Qualification Level 3

**Or**

1. Equivalent qualifications in a related field as determined by Kenya National Qualifications Authority (KNQA)

**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 conducted by accredited external assessors appointed by TVET CDACC.

**Certification**

A candidate will be issued with a national certificate of competency on demonstration of competence in a unit of competency. To attain the national qualification GIS Technology Level 4, 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:** IT/CU/GIS/BC/01/4/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Demonstrate communication skills

**Duration of Unit:** 20 Hours

**Unit Description**

This unit describes the competencies required to lead in the dissemination and discussion of ideas, information and issues in the workplace.

**Summary of Learning Outcomes**

1. Obtain and convey workplace information
2. Complete relevant work-related documents
3. Communicate information about workplace processes
4. Lead workplace discussion
5. Identify and communicate issues arising in the workplace

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Obtain and convey workplace information | * Communication process * Modes of communication * Medium of communication * Effective communication * Barriers to communication * Flow of communication * Sources of information * Types of questions * Organizational policies * Workplace etiquette * Ethical work practices in handling communication | * Observation * Interview * Third party reports |
| 1. Complete relevant work-related documents | * Types and purposes of workplace documents and forms * Methods used in filling forms and documents * Recording workplace data * Process of distributing workplace forms and documents * Report writing * Types of workplace reports | * Observation * Interview * Third party reports |
| 1. Communicate information about workplace processes | * 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 | * Observation * Interview * Portfolio |
| 1. Lead workplace discussion | * Methods of discussion e.g.   + Coordination meetings   + Toolbox discussion   + Peer-to-peer discussion * Solicitation of response | * Observation * Interview * Third party reports |
| 1. Identify and communicate issues arising in the workplace | * Identification of problems and issues * Organizing information on problems and issues * Relating problems and issues * Communication barriers affecting workplace discussions | * Observation * Interview * Portfolio |

**Suggested Delivery Methods**

* Discussion
* Role play
* Brainstorming

**Recommended Resources**

* Desktop computers/laptops
* Internet connection
* Projectors
* Telephone
* Report writing templates

## NUMERACY SKILLS

**UNIT CODE:**IT/CU/GIS/BC/02/4/A

**Relationship to Occupational Standards:**

This unit addresses the unit of competency: Demonstrate numeracy skills

**Duration of Unit:** 25hours

**Unit Description**

This unit describes the competencies required by a worker in order to competently identify and use whole numbers and simple fractions, decimals and percentages; Identify, measure and estimate familiar quantities for work, Read and use familiar maps, plans and diagrams for work, Identify and describe common 2D and some 3D shapes for work, Construct simple tables and graphs for work using familiar data, Identify and interpret information in familiar tables, graphs and charts for work.

**Summary of Learning Outcomes**

1. Identify and use whole numbers and simple fractions, decimals and percentages for work

2. Identify, measure and estimate familiar quantities for work

3. Read and use familiar maps, plans and diagrams for work

4. Identify and describe common 2D and some 3D shapes for work

5. Construct simple tables and graphs for work using familiar data

6. Identify and interpret information in familiar tables, graphs and charts for work

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify and use whole numbers and simple fractions, decimals and percentages for work | * Whole numbers * Simple fractions * Decimals * Percentages * Sizes * Problem solving methods * calculations using the 4 operations * Recording and communicating numerical information | * Oral * Written * Practical test * Observation |
| 2. Identify, measure and estimate familiar quantities for work | * Measurement information * Units of measurement * Estimate familiar and simple amounts * Selection of appropriate measuring equipment * Calculate using familiar units of measurement * Check measurements and results against estimates * Using informal and some formal mathematical and general language * Record or report results | * Oral * Written * Practical test * Observation |
| 3. Read and use familiar maps, plans and diagrams for work | * Maps, plans and diagrams * Locate items and places in familiar maps, plans and diagrams * Recognize common symbols and keys in familiar maps, plans and diagrams * Direction and location of objects, or route or places * Use of informal and some formal oral mathematical language and symbols | * Oral * Written * Practical test * Observation |
| 4. Identify and describe common 2D and some 3D shapes for work | * Common 2D shapes and 3D shapes * Classification of common 2D shapes and designs * Description of Use informal and some formal language to describe common two-dimensional shapes and some common three-dimensional shapes * Construction of common 2D shapes * Match common 3D shapes to their 2D sketches or nets | * Oral * Written * Practical test * Observation |
| 5. Construct simple tables and graphs for work using familiar data | * Types of graphs * Determination of data to be collected * Selection of data collection method * Collection of data * Determination of variables from the data collected * Order and collate data * Construct a table and enter data * Construct a graph using data from table * Check results * Report or discuss graph information related to work using informal and some formal mathematical and general language | * Oral * Written * Practical test * Observation |
| 6. Identify and interpret information in familiar tables, graphs and charts for work | * Tables construction and labeling * i.e. title, headings, rows and columns * Interpreting information and data in simple tables * Relaying information of relevant workplace tasks on/in a table * Identify familiar graphs and charts in familiar texts and contexts * Locate title, labels, axes, scale and key from familiar graphs and charts * Identify and interpret information and data in familiar graphs and charts * Relate information to relevant workplace tasks | * Oral * Written * Practical test * Observation |

**Suggested Delivery Methods**

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

**Recommended Resources**

* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Mathematical tables

## DIGITAL LITERACY

**UNIT CODE:** IT/CU/GIS/BC/02/4/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Demonstrate digital literacy

**Duration of Unit:** 35 hours

**Unit Description**

This unit covers the competencies required to effectively demonstrate digital literacy in a working environment. It entails identifying and using digital devices such as smartphones, tablets, laptops and desktop PCs for purposes of communication and performing work related tasks at the work place.

**Summary of Learning Outcomes**

1. Identify computer hardware and software
2. Apply security measures to data, hardware and software
3. Apply computer software in solving tasks
4. Apply internet and email in communication at workplace

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify computer hardware and software | * Meaning of a computer * Functions of a computer * Components of a computer * Classification of computers | * Written * Oral * 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 | * Written tests * Oral presentation * Observation * Projects |
| 1. Apply computer software in solving tasks | * Operating system * Word processing * Spread sheets * Data base | * Oral questioning * Observation * Project |
| 1. Apply internet and email in communication at workplace | * Computer networks * Uses of internet * Electronic mail (e-mail) concept | * Oral questioning * Observation * Oral presentation * Written report |

**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:** IT/CU/GIS/BC/03/4/A

**Relationship to occupational standards**

This unit addresses the unit of competency: Demonstrate entrepreneurial skills

**Duration of unit:** 60 hours

**Unit description**

This unit describes the competencies critical to demonstration of entrepreneurial skills. It includes creating and maintaining small scale business, establishing small scale business customer base, managing and growing a small business.

**Summary of Learning Outcomes**

1. Create and maintain small scale business
2. Establish small scale business customer base
3. Manage small scale business
4. Grow/ expand small scale business

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Create and maintain small scale business | * Starting a small business * Legal regulatory requirements in starting a small business * SWOT/ PESTEL analysis * Conducting market/industry survey * Generation and evaluation of business ideas * Matching competencies with business opportunities * Forms of business ownership * Location of a small business * Legal and regulatory requirement * Resources required to start a small business * Common terminologies in entrepreneurship * Entrepreneurship in national development * Self-employment * Formal and informal employment * Entrepreneurial culture * Myths associated with entrepreneurship * Types, characteristics, qualities & role of entrepreneurs * History, development and importance of entrepreneurship * Theories of entrepreneurship * Quality assurance for small businesses * Policies and procedures on occupational safety and health and environmental concerns | * Observation * Case studies * Individual/group assignments * projects * Written * Oral |
| 1. Establish small scale business customer base | * Good staff/workers and customer relations * Marketing strategy * Identifying and maintain new customers and markets * Product/ service promotions * Products / services diversification * SWOT / PESTEL analysis * Conducting a business survey * Generating Business ideas * Business opportunities | * Observation * Case studies * Individual/group assignments * projects * Written * Oral |
| 1. Manage small scale business | * Organization of a small business * Small business’ business plan * Marketing for small businesses * Managing finances for small business * Production/ operation process for goods/services * Small business records management * Book keeping and auditing for small businesses * Business support services * Small business resources mobilization and utilization * Basic business social responsibility * Management of small business * Word processing concepts in small business management * Computer application software * Monitoring and controlling business operations | * Oral * Observation * Case studies * Individual/group assignments * projects * Written |
| 1. Grow/expand small scale business | * Methods of growing small business * Resources for growing small business * Small business growth plan * Computer software in business development * ICT and business growth | * Observation * Case studies * Individual/group assignments * projects * Written |

**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
* Lap top/ desk top computer
* Internet
* Telephone
* Writing materials

## EMPLOYABILITY SKILLS

**UNIT CODE:**IT/CU/GIS/BC/04/4/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate employability skills

**Duration of Unit:** 30 hours

**Unit Description**

This unit covers competencies required to demonstrate employability skills. It involves conducting self-management, demonstrating critical safe work habits, demonstrating workplace learning and workplace ethics.

**Summary of Learning Outcomes**

1. Conduct self-management
2. Demonstrate critical safe work habits
3. Demonstrate workplace learning
4. 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 * 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 critical safe work habits | * Stress and stress management * Punctuality and time consciousness * Interpersonal communication * Sharing information * Leisure * Integrating personal 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. Demonstrate workplace learning | * Personal training needs identification and assessment * 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 * Workplace innovation * Performance improvement * Handling emerging issues * Future trends and concerns in learning | * 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:** IT/CU/GIS/BC/05/4/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Demonstrate environmental literacy

**Duration of Unit:** 20hours

**Unit Description**

This unit describes the competencies required to control environmental hazard, control environmental pollution, comply with workplace sustainable resource use and evaluate current practices in relation to resource usage.

**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

**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 |

**Suggested Delivery Methods**

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

**Recommended Resources**

* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Solid Waste Act
* Environmental Management and Coordination Act 1999
* Machine/equipment manufacturer’s specifications and instructions
* Personal Protective Equipment (PPE)

## OCCUPATIONAL SAFETY AND HEALTH PRACTICES

**UNIT CODE:** IT/CU/GIS/BC/06/4/A

**Relationship to Occupational Standards**

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

**Duration of Unit:** 20 hours

**Unit Description**

This unit describes the competencies required to practice safety and health, and comply with OSH requirements relevant to work.

**Summary of Learning Outcomes**

1. Observe workplace procedures for hazards and risk prevention
2. Participate for workplace safety and health maintenance

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment**  **Methods** |
| 1. Observe workplace procedures for hazards and risk prevention | * Arrangement of work area and items in accordance with Company housekeeping procedures * Adherence to work standards and procedures * Application of preventive and control measures, including use of safety gears/PPE * Study and apply standards and procedures for incidents and emergencies. | * Oral questions * Written questions * Observation of work procedures |
| 1. Participate in arrangements for workplace safety and health maintenance | * Participating in orientations on OSH requirements/regulations of tasks * Providing feedback on health, safety, and security concerns to appropriate personnel as required in a sufficiently detailed manner * Practice workplace procedures for reporting hazards, incidents, injuries and sickness * OSH requirements/ regulations and workplace safety and hazard control procedures are reviewed, and compliance reported to appropriate personnel * Identification of needed OSH-related trainings are proposed to appropriate personnel | * Oral questions * Written tests * Practical test * Observation of practical work by trainees |

**Suggested Delivery Methods**

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

**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 bootsn
* 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 vests

# CORE UNITS OF LEARNING

## FOUNDATIONS OF GEOGRAPHICAL INFORMATION SYSTEMS (GIS)

**UNIT CODE:** IT/CU/GIS/CC/01/4/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Recognise foundations of Geographical Information Systems (GIS)

**Duration of Unit:**80 hours

**Unit Description:**

This unit covers the competencies required to demonstrate foundational GIS concepts, identify GIS components, demonstrate data models in GIS systems and recognise GIS applications in real life.

**Summary of Learning Outcomes:**

1. Demonstrate foundational GIS concepts

2. Identify GIS components

3. Demonstrate data models in GIS systems

4. Recognise GIS applications in real life

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. 1. Demonstrate foundational GIS concepts | * GIS key terms and terminologies * Attribute * **Coordinate System** * **Datum** * Digital Elevation Model * **Esri** * **Geocode** * **Geodatabase** * **Georeference** * **GIS** * **Layer** * **Metadata** * **Projection** * **QGIS** * **Raster Data** * **Topography** * **Topology** * **Vector Data** * Geographical Information Systems (GIS) * Definition of GIS * Role of GISs * GIS operations and functions * Data Input * Data Storage * Data Manipulation and Processing * Data output * Geographical Concepts * Categories: Location, Direction, Space, Navigation * Illustration of concepts * Geographic Information Technologies * Remote Sensing (RS) * Global Positioning System (GPS) * Geographic Information Software (GIS) | * Practical * Oral questioning * Written test |
| 1. 2. Identify GIS components | * Components of a GIS * Hardware * GIS software and other complementary software * People/Users * Methods/Procedures * Data and data sources * GIS software * ArcGIS (Esri) - Desktop, Online * QGIS (Open Source) * Geomedia (Hexagon Geospatial) * MapInfo Professional (Pitney Bowes) * Manifold GIS (Manifold) * AutoCAD Map 3D (Autodesk) * Demonstration of ArcGIS desktop software tool features | * Practical * Observation * Written tests * Oral |
| 1. Demonstrate data models in GIS systems | * Data models * Definition * Role of GIS data models * Types of data models * Raster model * Vector model * Comparison of models * Illustration of application areas of data models | * Observation * Written tests * Oral * Practicals |
| 1. Identify GIS applications in organisations | * Areas of GIS application * Challenges in the GIS field * Technology trends driving geospatial development * Miniaturization of Technologies * Proliferation of New Mobile Geospatial Sensor Platforms * Expanding Wireless and Web Networks * Advances in Computing Capacity for Geospatial Research * Areas impacted by geospatial technology trends. | * Written * Oral * Observation |

**Suggested Methods of Delivery**

* Instructor led facilitation of theory
* Demonstration by trainer
* Practical work done by trainee
* Group discussions

The delivery may also be supplemented and enhanced by the following, if the opportunity allows:

* Visiting lecturer/trainer/expert from a GIS related field;
* Industrial visits.

**Recommended Resources**

|  |
| --- |
| **Tool.**   * GIS software, Internet, MS Office, MS Project |
| **Equipment**   * Computer * Printers * Scanners |
| **Materials and supplies**  **Materials**   * Digital instructional material including online resources, DVDs and CD, stationery, map images   **Supplies**   * Printing materials |
| **Reference materials**  Software manuals |

## MANAGEMENT OF GIS DATA

**UNIT CODE:** IT/CU/GIS/CC/02/4/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Use and Manage GIS data

**Duration of Unit:** 100 hours

**Unit Description:**

This unit covers the competencies required to identify GIS data foundational concepts, build a relational database, query a relational database and generate relational database reports.

**Summary of Learning Outcomes:**

1. Identify GIS data foundational concepts

2. Build a relational database

3. Query a relational database

4. Generate relational database reports

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify GIS data foundational concepts | * Types of GIS data * Vector * Raster * Common GIS data formats * CSV * Shapefile * Tab * KML * GeoJSON * Sources of GIS data * Google * Excel files * Government web sites * Data preparation methods * Table Joins * Geocoding addressing * Filtering a dataset | * Practical * Oral questioning * Written test |
| 1. Build a relational database | * Relational database management concepts * Relational Database Concepts * Relation/Table * Tuple/Record * Attribute/Field * Domain * Keys * Entity integrity * Referential integrity * Role of RDBMS in GIS spatial data management * Geographic Data * metadata/attributes data (Region, Land Area, Population, etc.) * Relational representation of metadata * MS Access features * Structured Query Language * Characteristics of SQL * Data Definition Commands * Data Manipulation commands * Creating a database using MS Access * Attribute Data types * Creating and modifying tables * Joining tables * Inserting data * Deleting data * Creating Forms | * Practicals * Observation * Written tests * Oral |
| 1. Query a relational database | * Queries Concept * Definition of query * Query Structure * SQL SELECT queries * SELECT statement * The WHERE CLAUSE * Sorting using ORDER BY * Comparison Operators * Aggregate functions * Creating Simple Joins * Extracting GIS information * Selecting relevant GIS attributes * Applying SQL SELECT statements to extract attribute data | * Observation * Written tests * Oral * Practicals |
| 1. Generate relational database reports | * Reports in a relational database * Purpose of reports * Considerations for report creation * Designing a MS Access report * Parts of a Report * Report Design Techniques on MS Access * Generating Database Reports * Viewing a Report * Printing a Report | * Written * Oral * Observation * Practical |

**Suggested Methods of Delivery**

* Instructor led facilitation of theory
* Demonstration by trainer
* Practical work done by trainee
* Group discussions

The delivery may also be supplemented and enhanced by the following, if the opportunity allows:

* Visiting lecturer/trainer from GIS related sector;
* Industrial visits.

**Recommended Resources**

|  |
| --- |
| **Tool.**   * ArcGIS, MS Access, Internet |
| **Equipment**   * Computer * Printers * Scanners |
| **Materials and supplies**  **Materials**   * Digital instructional material including online resources, DVDs and CD, stationery, Raster images   **Supplies**   * Printing materials |
| **Reference materials**  Software manuals |

**GIS DATA VISUALIZATION USING MAPS**

**UNIT CODE:** IT/CU/GIS/CC/03/4/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: GIS Data Visualization Using Maps

**Duration of Unit:** 100 hours

**Unit Description:**

This unit covers the competencies required to demonstrate foundational map concepts, generate simple maps using a GIS tool, explore GIS mapping capabilities and generate map projections.

**Summary of Learning Outcomes:**

1. Demonstrate foundational map concepts

2. Generate simple maps using a GIS tool

3. Explore GIS mapping capabilities

4. Generate map projections

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Demonstrate foundational map concepts | * Maps concept * Definition of map * Map functions: * Spatial database * Communication * Map types * Category * Quantity * Bubble * Heat * Cluster * Reference * Thematic * Dynamic * Feature * Choropleth * Dot density * Contour * Demonstrating Map stacking * Definition of stacking * Stacking rules * Enabling stacking * Stacking GIS map layers * Demonstrating interactivity tools * Location information/points of interest * Map queries | * Practical * Oral questioning * Written test |
| 1. Generate simple maps using a GIS tool | * Cartographic design features * Size * Scale * Shape * Symbols * Labelling * Fonts and font sizes * Map elements * Data area/pane * neat line * Scale bars * Legends * Titles * North Arrow * Illustrating map scales * Large scale * Medium scale * Small scale * Creating maps using ArcGIS * Loading Geospatial data into ArcMap * Identifying the features and attributes to present * Defining how to show data * Adding map components * Exporting maps | * Practical * Observation * Written tests * Oral |
| 1. Explore GIS mapping capabilities | * Mapping Location of things using ArcGIS * Mapping Quantities using ArcGIS * Mapping Densities using ArcGIS * Mapping Features inside regions using ArcGIS * Mapping Change in areas using ArcGIS | * Observation * Written tests * Oral * Practical |
| 1. Generate map projections | * Illustrating Earth model reference elements * Latitude * Longitude * Demonstrating Cartesian coordinates * Assigning map coordinates and spatial location * Map projections using Cartesian coordinates * 3D coordinate systems * Kenya Geodetic reference system * Official Mapping Institutions * Coordinate Systems The Cassini-Soldner, East African war system, UTM coordinate system. * GPS Observation stations * Map projection styles * Demonstrating the Universal Transverse Mercator (UTM) projection style | * Written * Oral * Observation |

**Suggested Methods of Delivery**

* Instructor led facilitation of theory
* Demonstration by trainer
* Practical work done by trainee
* Group discussions

The delivery may also be supplemented and enhanced by the following, if the opportunity allows:

* Visiting lecturer/trainer from GIS related sector;
* Industrial visits.

**Recommended Resources**

|  |
| --- |
| **Tool.**   * ArcGIS, Internet |
| **Equipment**   * Computer * Printers * Scanners |
| **Materials and supplies**  **Materials**   * Digital instructional material including online resources, DVDs and CD, stationery, Maps   **Supplies**   * Printing materials |
| **Reference materials**  Software manuals |

## GIS DATA ANALYTICS

**UNIT CODE:** IT/CU/GIS/CC/04/4/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Perform GIS Data Analytics

**Duration of Unit:** 110 hours

**Unit Description:**

This unit covers the competencies required to summarize data, find locations, analyse patterns and find proximity using ArcGIS.

**Summary of Learning Outcomes:**

1.Summarize data

2.Find locations

3.Analyse patterns

4. Find proximity

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Summarize data | * Performing Points aggregation * Purpose of Aggregate Points tool * Aggregating points using polygons and using bins * Joining Features * Purpose of the Join Features tool * Demonstrating Joining Features using a spatial relationship and using attributes * Performing “Summarize Nearby” * Purpose of Summarize Nearby * Demonstrating line distance and Travel mode options * Performing “Summarize within” * Purpose of Summarize within * Demonstrating Summarize within | * Practical * Oral questioning * Written test |
| 1. Find locations | * Determining Existing locations * Explanation of Existing Locations * Building query expressions to find existing locations * Deriving New locations * Explanation of New Locations * Building query expressions to derive new locations * Identifying Similar locations * Explanation of Similar Locations * Using the Select button and Query buttons to make a selection * Identifying Best facilities * Explanation of Best Facilities * Selecting an appropriate goal * Specifying facilities | * Practical * Observation * Written tests * Oral |
| 1. Analyse patterns | * Calculating Density * Purpose of Calculate Density tool * Calculating density using point and line features * Identifying Hot spots * Explanation of Hot spots * Analysing Area Features * Interpreting results * Identifying Outliers * Purpose of Find Outliers tool * Identifying outliers using Areas | * Observation * Written tests * Oral * Practicals |
| 1. Find proximity | * Creating Buffers * Explanation of Buffers * Creating buffers using Distance * Extracting Nearest features * Explanation of Find Nearest * Extract Nearest Features using Distance * Creating Drive-Time areas * Explanation of Drive-Time areas * Creating Drive-Time areas using Time | * Written * Oral * Observation |

**Suggested Methods of Delivery**

* Instructor led facilitation of theory
* Demonstration by trainer
* Practical work done by trainee
* Group discussions

The delivery may also be supplemented and enhanced by the following, if the opportunity allows:

* Visiting lecturer/trainer from GIS related sector;
* Industrial visits.

**Recommended Resources**

|  |
| --- |
| **Tool.**   * ArcGIS, Internet |
| **Equipment**   * Computer * Printers |
| **Materials and supplies**  **Materials**   * Digital instructional material including online resources, DVDs and CD, stationery, Maps   **Supplies**   * Printing materials |
| **Reference materials**  Software manuals |

## TERRAINS AND IMAGES ANALYSIS

**UNIT CODE:** IT/CU/GIS/CC/05/4/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Terrains and Images Analysis

**Duration of Unit:** 100 hours

**Unit Description:**

This unit covers the competencies required to recognise terrain analysis areas, identify terrain characteristics, perform terrain analysis using a GIS tool and identify key elements in aerial and satellite image capture.

**Summary of Learning Outcomes:**

1. Recognise terrain analysis areas

2. Identify terrain characteristics

3. Perform terrain analysis using a GIS tool

4. Identify key elements in aerial and satellite image capture.

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Recognize terrain analysis areas | * Terrain analysis Concept * Explanation of terrain analysis * Key terrain variables * Height * Slope * Aspect * Visibility * Profile curvature * Illustrating Terrain analysis areas * Inventory forest resource * Assess slope erosion potential * Determine habit suitability * Advising on land use | * Practical * Oral questioning * Written test |
| 2. Demonstrate terrain characteristics | * Illustrating Terrain analysis functions * Hydrological functions: watershed, flow direction, drainage network * Viewsheds * Shaded relief maps * Recognising Slope and Aspect from ready images * Interpreting Slope and Aspect | * Practical * Observation * Written tests * Oral |
| 3. Perform terrain analysis using a GIS tool | * ArcGIS Geoprocessing tools * Conversion tools * Functional Surface tools * Triangulated Surface tools * Visibility tools * Selecting Terrain data sets * Formats of terrain data sets * Types of source data supported in terrain datasets * Properties of terrain datasets * Data import and load tools for terrain datasets * Building a terrain dataset with Geoprocessing tools * Applying Surface slope and Surface Aspect tools * Slope polygon codes and their meanings * Aspect codes and their meanings | * Observation * Written tests * Oral * Practical |
| 4. Identify key elements in aerial and satellite image capture. | * Essential features of quality aerial images * Image resolution * Image scale * Image extent * Tools for capturing aerial images * Digital aerial cameras * Film and film cameras * Photogrammetry software * Basic principles of satellite scanners * Components of scanners * Remote sensors in satellite imaging | * Written * Oral * Observation |

**Suggested Methods of Delivery**

* Instructor led facilitation of theory
* Demonstration by trainer
* Practical work done by trainee
* Group discussions

The delivery may also be supplemented and enhanced by the following, if the opportunity allows:

* Visiting lecturer/trainer from GIS related sector;
* Industrial visits.

**Recommended Resources**

|  |
| --- |
| **Tool.**   * ArcGIS, Internet |
| **Equipment**   * Computer * Printers |
| **Materials and supplies**  **Materials**   * Digital instructional material including online resources, DVDs and CD, stationery, Aerial and Satellite maps   **Supplies**   * Printing materials |
| **Reference materials**  Software manuals |

## GIS STANDARDS AND COMPLIANCE

**UNIT CODE:** IT/CU/GIS/CC/06/4/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Identify GIS standards and compliance areas

**Duration of Unit:** 80 hours

**Unit Description:**

This unit covers the competencies required to recognise data spatial standards, measure data accuracy, evaluate state of GIS implementation in Kenya and recognise statutory and other compliance frameworks.

**Summary of Learning Outcomes:**

1. Recognise spatial data standards

2. Measure data accuracy

3. Evaluate state of GIS implementation in Kenya

4. Recognise statutory and other compliance frameworks

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Recognize spatial data standards | * Standards concept * Role of standards * Open standards for GIS technologies * Benefits of standards * Key Standards Development Organizations for Geospatial Information * Types of GIS standards * Data * Interoperability * Analysis * Professional or certification * National * International * Spatial data standards * Media * Format * Data Accuracy * Documentation | * Practical * Oral questioning * Written test |
| 1. Measure data accuracy | * Types of Errors * Positional accuracy * Attribute accuracy and precision * Conceptual accuracy and precision * Sources of errors * Age of data * Area Cover * Map scale * Density of observations * Relevance of data * Format of data * Cost of obtaining data * Accessibility to data * Illustrating positional accuracy * ArcGIS Positional Accuracy Assessment Tool (PAAT) * Using the PAAT | * Practicals * Observation * Written tests * Oral |
| 1. Evaluate state of GIS implementation in Kenya | * Available infrastructure * Role of Managing institutions * Current Coordinate systems * Locations of current GPS stations * Spatial Planning stakeholders * National Government * County Governments * Survey professionals * Telecommunication firms * Challenges of implementing GISs | * Observation * Written tests * Oral * Practical |
| 1. Apply statutory and other compliance frameworks | * GIS professional guidelines * Professional conduct guidelines * Ethical guidelines * Relevant national laws * Physical Planning Act 2010 * National Land Commission Act 2012 * Urban Areas and Cities Act 2019 * Land Act 2012 * International standards * [ISO 6709:2008](https://www.iso.org/standard/39242.html?browse=tc) * ISO 19115 | * Written * Oral * Observation |

**Suggested Methods of Delivery**

* Instructor led facilitation of theory
* Demonstration by trainer
* Practical work done by trainee
* Group discussions

The delivery may also be supplemented and enhanced by the following, if the opportunity allows:

* Visiting lecturer/trainer from GIS related sector;
* Industrial visits.

**Recommended Resources**

|  |
| --- |
| **Tool.**   * Software ArcGIS, Internet |
| **Equipment**   * Computer * Printers |
| **Materials and supplies**  **Materials**   * Digital instructional material including online resources, DVDs and CD, stationery, Maps   **Supplies**   * Printing materials |
| **Reference materials**  Software manuals |