

**REPUBLIC OF KENYA**

**COMPETENCY BASED CURRICULUM**

**FOR**

**PHOTOGRAMMETRY AND REMOTE SENSING**

**LEVEL 6**



TVET CDACC

P.O BOX 15745-00100

NAIROBI

First published 2019

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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 Land Survey and Mapping 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 Land Survey and Mapping 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, Land Survey and Mapping 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 Land survey and mapping 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 Land Survey and Mapping 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

CC Common Competency

CDACC Curriculum Development, Assessment and Certification Council

CPU Central Processing Unit

CR Core Competency

CU Curriculum

EPS Expanded Polystyrene Systems

ICT Information Communication Technology

KCPE Kenya Certificate of Primary Education

KCSE Kenya Certificate of secondary Education

KNQA Kenya National Qualifications Authority

NEMA National Environmental Management Authority

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

# KEY TO UNIT CODE

LSM/ CU/ PRS/ 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 to conduct Aerial Photogrammetry, Close Range Photogrammetry, Digital Photogrammetry, Topographic Mapping, Remote Sensing Projects and Satellite Photogrammetry.

It consists of Basic, common and core units of learning as listed below.

**BASIC UNITS OF LEARNING**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration In Hrs** | **Credit Factors** |
| LSM/CU/PRS/BC/01/6/A | Communication Skills | 40 | 4 |
| LSM/CU/PRS/BC/02/6/A | Numeracy | 60 | 6 |
| LSM/CU/PRS/BC/03/6/A | Digital Literacy | 60 | 6 |
| LSM/CU/PRS/BC/04/6/A | Entrepreneurship | 100 | 10 |
| LSM/CU/ALM/BC/05/6/A | Employability Skills | 80 | 8 |
| LSM/CU/PRS/BC/06/6/A | Environmental Literacy | 40 | 4 |
| LSM/CU/PRS/BC/07/6/A | Occupational Safety and Health Practices | 40 | 4 |
|  | **TOTAL** | **420** | **42** |

**COMMON UNITS OF LEARNING**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration In Hrs** | **Credit Factors** |
| LSM/OS/PRS/CC/01/6/A | Applied Mathematics | 100 | 10 |
| LSM/OS/PRS/CC/02/6/A | Principles of Land Survey | 140 | 14 |
| LSM/OS/PRS/CC/03/6/A | Photogrammetric Equipment | 140 | 14 |
| LSM/OS/PRS/CC/04/6/A | Principles of GIS | 120 | 12 |
| LSM/OS/PRS/CC/05/6/A | Principles of Cartography | 120 | 12 |
| LSM/CU/PRS/CC/06/6/A | Land Laws | 120 | 12 |
|  | **TOTAL** | **740** | **74** |

**CORE UNITS OF LEARNING**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration In Hrs** | **Credit Factors** |
| LSM/OS/PRS/CR/01/6/A | Aerial Photogrammetry | 200 | 20 |
| LSM/OS/PRS/CR/02/6/A | Close Range Photogrammetry | 200 | 20 |
| LSM/OS/PRS/CR/03/6/A | Digital Photogrammetry | 200 | 20 |
| LSM/OS/PRS/CR/04/6/A | Topographic Mapping | 200 | 20 |
| LSM/OS/PRS/CR/05/6/A | Remote Sensing Projects | 200 | 20 |
| LSM/OS/PRS/CR/06/6/A | Satellite Photogrammetry | 200 | 20 |
|  | Industrial attachment | 480 | 48 |
|  | **TOTAL** | **1680** | **168** |
|  | **GRAND TOTAL** | **2840** | **284** |

The total duration of the course is **2840** 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)

**Trainer Qualification**

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

**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.

**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 Photogrammetry and Remote Sensing, 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:** LSM/CU/PRS/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 Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Meet communication needs of clients and colleagues | * Communication process * Modes of communication * Medium of communication * Effective communication * Barriers to communication * Flow of communication * Sources of information * Organizational policies * Organization requirements for written and electronic communication methods * Report writing * Effective questioning techniques (clarifying and probing) * Workplace etiquette * Ethical work practices in handling communication * Active listening * Feedback * Interpretation * Flexibility in communication * 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:** LSM/CU/PRS/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 Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 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:** LSM/CU/PRS/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 Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify computer hardware and software | * Concepts of ICT * Functions of ICT * History of computers * Components of a computer * Classification of computers | * Written tests * Oral presentation |
| 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:** LSM/CU/PRS/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** | **Suggested Assessment Methods** |
| 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:** LSM/CU/PRS/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 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 * 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**

* Demonstrations
* Simulation/Role play
* Group Discussion
* Presentations
* Assignments
* Q&A

**Recommended Resources**

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

## ENVIRONMENTAL LITERACY

**UNIT CODE**:LSM/CU/PRS/BC/05/6/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 Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 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:** LSM/CU/PRS/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 Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify workplace hazards and risks | * Identification of hazards in the workplace and/or the indicators of their presence * Evaluation and/or work environment measurements of OSH hazards/risk existing in the workplace * 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

# 

## APPLIED MATHEMATICS

**UNIT CODE:** LSM/CU/PRS/CC/01/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply mathematical skills

**Duration of Unit:** 100 hours

**Unit Description**

This unit describes the competencies required by a technician in order to apply algebra apply trigonometry and hyperbolic functions, apply complex numbers, apply coordinate geometry, carry out binomial expansion, apply calculus, solve ordinary differential equations, carry out mensuration, apply power series, apply statistics, apply numerical methods, apply vector theory and apply matrix.

**Summary of Learning Outcomes**

1. Apply Algebra
2. Apply Trigonometry and hyperbolic functions
3. Apply complex numbers
4. Apply Coordinate Geometry
5. Carry out Binomial Expansion
6. Apply Calculus
7. Solve Ordinary differential equations
8. Carry out Mensuration
9. Apply Power Series
10. Apply Statistics
11. Apply Vector theory
12. Apply Matrix
13. Apply Numerical methods

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Apply Algebra | * Base and Index * Law of indices * Indicial equations * Laws of logarithm * Logarithmic equations * Conversion of bases * Use of calculator * Reduction of equations * Solution of equations reduced to quadratic form * Solutions of simultaneous linear equations in three unknowns * Solutions of problems involving AP and GP | * Written tests * Oral questioning * Assignments * Supervised exercises |
| 1. Apply Trigonometry and hyperbolic functions | * Half -angle formula * Factor formula * Trigonometric functions * Parametric equations * Relative and absolute measures * Measures calculation * Definition of hyperbolic equations * Properties of hyperbolic functions * Evaluations of hyperbolic functions Hyperbolic identities * Osborne’s Rule * Ashx+bshx=C equation * One-to-one relationship in functions * Inverse functions for one-to-one relationship * Inverse functions for trigonometric functions * Graph of inverse functions * Inverse hyperbolic functions | * Written tests * Oral questioning * Assignments * Supervised exercises |
| 1. Apply complex numbers | * Definition of complex numbers * Stating complex numbers in numbers in terms of conjugate argument and * Modulus * Representation of complex numbers on the Argand diagram * Arithmetic operation of complex numbers Application of De Moivre’s theorem * Application of complex numbers to engineering | * Assignments * Oral questioning * Supervised exercises * Written tests |
| 1. Apply Coordinate Geometry | * Polar equations * Cartesian equation * Graphs of polar equations * Normal and tangents * Definition of a point * Locus of a point in relation to a circle * Loci of points for given mechanism | * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises * Written tests |
| 1. Carry out Binomial Expansion | * Binomial theorem Power series using binomial theorem Roots of numbers using binomial theorem. * Estimation of errors of small changes using binomial theorem | * Assignments * Supervised exercises * Written tests |
| 1. Apply calculus | * Definition of derivatives of a function * Differentiation from fist principle * Tables of some common derivatives * Rules of differentiation * Rate of change and small change * Stationery points of functions of two variables * Definition of integration * Indefinite and definite integral * Methods of integration application of integration. * Integrals of hyperbolic and inverse functions | * Assignments * Supervised exercises * Written tests |
| 1. Solve Ordinary differential equations | * Types of first order differential equations * Formation of first order differential equation * Solution of first order differential equations * Application of first order differential equations * Formation of second order differential equations for various systems * Solution of second order differential equations * Application of second order differential equations | * Assignments * Oral questioning * Supervised exercises * Written tests |
| 1. Carry out Mensuration | * Units of measurements * Perimeter and areas of regular figures * Volume of regular solids * Surface area of regular solids * Area of irregular figures   + Areas and volumes using Pappus theorem | * Assignments * Supervised exercises * Written tests |
| 1. Apply Power Series | * Definition of the term power series * Taylor’s theorem * Deduction of Maclaurin’s theorem to obtain power series * Application of Taylor’s theorem and Maclaurin’s theorems in numerical work | * Written tests * Assignments * Supervised exercises |
| 1. Apply Statistics | * Classification of data * Grouped data * Ungrouped data * Data collection * Tabulation of data * Class intervals * Class boundaries * Frequency tables * Diagrammatic and graphical presentation of data e.g. * Histograms * Frequency polygons * Bar charts * Pie charts * Cumulative frequency curves * Measures of central tendency mean, mode and median * Measures of dispersion * Variance and standard deviation * Definition of probability * Laws of probability * Expectation variance and S.D. * Types of distributions * Mean, variance and SD of probability distributions * Application of probability distributions * Standard normal tables * Sampling distributions * Rank correlation coefficient | * Oral questioning * Written tests * Assignments * Supervised exercises |
| 1. Apply Numerical methods | * Definition of interpolation and extrapolation * Application of interpolation * Application of interactive methods to solve equations * Application of interactive methods to areas and volumes | * Assignments * Oral questioning * Supervised exercises * Written tests |
| 1. Apply Vector theory | * Vectors and scalar in two and three dimensions * Operations on vectors: Addition and Subtraction * Position vectors * Resolution of vectors | * Assignments * Oral questioning * Supervised exercises * Written tests |
| 1. Apply Matrix methods | * Matrix operation * Determinant of 3x3 matrix * Inverse of 3x3 matrix * Solution of linear simultaneous equations in 3 unknowns * Application of matrices | * Assignments * Oral questioning * Supervised exercises * Written tests |

**Suggested Methods of instruction**

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

**Recommended Resources**

* Scientific Calculators
* Rulers, pencils, erasers
* Charts with presentations of data
* Graph books
* Dice
* Computers with internet connection

## PRINCIPLES OF LAND SURVEYING

**UNIT CODE:** LSM/CU/PRS/CC/02/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: apply principles of land surveying

**Duration of Unit:** 140 hours

**Unit Description**

This unit describes the basic competencies required by a land surveyor to operate survey equipment, collect data, process data and present data.

**Summary of Learning Outcomes**

1. Operate survey equipment
2. Collect data
3. Present and analyse data
4. Present data

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

|  |  |  |
| --- | --- | --- |
| **Learning outcome** | **Content** | **Suggested Assessment Methods** |
| * + - 1. Operate survey equipment | * Classification of survey equipment * Handling survey equipment * Setting up of survey equipment * Maintenance of survey equipment | * Observation * Oral Questioning * Written Tests * Projects |
| * + - 1. Collect data | * Basic survey data * Data collection methods * Data collection tools * Checking of field data * Data storage | * Observation * Oral Questioning * Written Tests * Projects |
| * + - 1. Process and analyse data | * Data processing methods * Relevant processing tools * Data analysis | * Observation * Oral Questioning * Written Tests * Projects |
| * + - 1. Present processed data | * Data presentation format * Preparation of presentation format | * Observation * Oral Questioning * Written Tests * Projects |

**Suggested Methods of Instruction**

* Group discussions
* Demonstration by trainer
* Exercises by trainee

**Recommended Resources**

* Data
* Computers with CAD software.
* Computers with network processing software.
* Plotters and printers
* Projectors
* Smart boards
* Data collection equipment
* Scanners
* Servers
* Archiving devices
* Internet

## PHOTOGRAMMETRIC EQUIPMENT

**UNIT CODE: LSM/OS/PRS//CR/03/6/A**

**Duration of Unit:** 140 Hours

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Operate Photogrammetric Equipment

**Unit Description**

This unit covers the competencies required to operate photogrammetric equipment. Competencies include: Identify equipment types and components, perform stereoscopic viewing, perform interior orientation, perform relative orientation, perform absolute orientation, apply photogrammetric software and perform feature extractions and products compilations.

**Summary of Learning Outcomes**

1. Identify equipment types and components
2. Perform stereoscopic viewing
3. Perform interior orientation
4. Perform relative orientation
5. Perform absolute orientation
6. Apply photogrammetric software
7. Perform feature extractions and product compilations

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify equipment types and components | * + Photogrammetric equipment types   + Components Equipment   + Routine maintenance of different equipment   + Maintenance and updating of equipment inventory | * Observation * Oral questioning * Written tests * Practical assessments |
| 1. Perform stereoscopic viewing | * + Assembly of stereoscope   + Baselining of an overlapping stereo pair * Measurement of parallax using parallax bar | * Observation * Oral questioning * Written tests * Practical assessments |
| 1. Perform interior orientation | * + Camera parameters   + Measurement of Fiducial marks   + Evaluation of RMS error | * Observation * Oral questioning * Written tests |
| 1. Perform relative orientation | * + Clear Parallax in the six standard points   + Computation of Relative orientation parameters   + Evaluation of orientation results | * Observation * Oral questioning * Written tests/drawings and sketches * Practical Tests |
| 1. Perform absolute orientation | * + Identification of Horizontal and vertical control points   + Computation of Model transformation parameters * Evaluation of orientation results | * Observation * Oral questioning * Sketches and drawings * Practical Tests |
| 1. Apply photogrammetric software | * + Identification of Types of software   + Software fundamentals   + Digital data file formats   + Conversion of data formats | * Observation * Oral questioning * Written tests * Practical assessments |
| 1. Perform products extractions and compilations | * + Determine types of photogrammetric features required   + Perform feature extraction   + Methods of feature extraction | * Observation * Oral questioning * Written tests * Practical assessments |

**Suggested Methods of Instruction**

* Teaching
* Demonstration by trainer
* Practical work by trainee
* Demonstration videos
* Projects
* Group discussions
* Group projects
* Industry based learning

**Recommended Resources**

* Survey and photogrammetric equipments and tools
* Survey data plans
* CAD and photogrammetric software
* Computers
* Stationery
* Online resources
* Storage media
* Transportation
* Store
* Photogrammetric lab
* Reference Text Books

## PRINCIPLES OF GIS

**UNIT CODE:** LSM/CU/PRS/CC/04/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: apply principles of GIS

**Duration of Unit:** 120 hours

**Unit Description**

This unit describes the competencies required by a cartographer to collect data, pre-process data, process data, present data, store and archive data and design and publish web-based maps

**Summary of Learning Outcomes**

1. Collect data
2. Pre-process
3. Process data
4. Store and archive data

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

|  |  |  |
| --- | --- | --- |
| **Learning outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Collect data | * Components of GIS * Sources of mapping data * Methods of data collection * Data collection equipment * Data models * Data digitization | * Observation * Oral Questioning * Written Tests * Projects |
| 1. Pre-process data | * Data cleaning * Data selection * Checking of projections * Harmonizing scales * Data evaluation | * Observation * Oral Questioning * Written Tests * Projects |
| 1. Process data | * Geo-referencing * Digitization * Editing * Layering * Overlay * Attributes entry * Creation of Geo-database * Map design | * Observation * Oral Questioning * Written Tests * Projects |
| 1. Present data | * Arranging data layer * Designing map layouts * Web maps are published * Map is exported | * Observation * Oral Questioning * Written Tests * Projects |
| 1. Store and archive data | * Cataloguing * Archiving devices * Cloud archiving * Data organization   + Partitioning drives   + Spatial indexing   + metadata * Data compression | * Observation * Oral Questioning * Written Tests * Projects |

**Suggested Methods of Instruction**

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

**Recommended Resources**

* Data
* Computers with GIS software.
* Plotters and printers
* Projectors
* Smart boards
* Data collection equipment
* Scanners
* Servers
* Archiving devices
* Internet

## PRINCIPLES OF CARTOGRAPHY

**UNIT CODE:** LSM/CU/PRS/CC/05/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply principles of cartography

**Duration of Unit:** 120 hours

**Unit Description**

This unit describes the competencies required by a surveyor to apply cartographic techniques, communicate using maps, distinguish between maps and plans, determine scale of maps and plans, compile and project maps, apply principles of reference systems and represent relief

**Summary of Learning Outcomes**

1. Apply cartographic techniques
2. Communicate using maps
3. Distinguish between maps and plans
4. Determine scale of maps and plans
5. Compile maps
6. Project maps
7. Apply principles of reference systems
8. Represent relief

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| * + 1. Apply cartographic techniques | * Meaning of cartographic techniques * Terms used in cartography * Drawing instruments and their use * Care of drawing instruments and materials * Types and characteristics of drawing materials * Drawing media and inks * Properties of good drawing materials * Mapping scales * Classification of mapping scales * Methods of scale change * Map texts * Lettering * Construction of rectangular grid | * Observation * Oral questioning * Written tests * Projects |
| * + 1. Communicate using maps | * Process of cartographic communication * Cartographic symbols | * Observation * Oral questioning * Written tests * Projects |
| * + 1. Distinguish between maps and plans | * Types of maps * Types of plans | * Observation * Oral questioning * Written tests * Projects |
| * + 1. Determine scale of maps and plans | * Type of scales * Determination of scales * Application of Scales | * Observation * Oral questioning * Written tests * Projects |
| * + 1. Compile maps | * Sources of mapping data * Phases of map compilation * Types of map compilation * Compilation procedure * Generalization * Map design | * Observation * Oral questioning * Written tests * Projects |
| * + 1. Project maps | * Meaning of map projection * Basic concepts in map projection * Classification of map projections * Characteristics of map projections * Commonly used projections * Map grids * Factors influencing choice of projection | * Observation * Oral questioning * Written tests * Projects |
| * + 1. Apply principles of reference systems | * Meaning of reference systems * Earth’s Geometry   + Geoid   + Spheroid / Ellipsoid   + Spherical * Types of coordinate systems   + Geographical   + Cartesian   + Projected (UTM, Cassini) | * Observation * Oral questioning * Written tests * Projects |
| * + 1. Represent relief | * Methods of showing relief * Construction of profiles * Calculation of gradients * Contour interpolation * Inter-visibility | * Observation * Oral questioning * Written tests * Projects |

**Suggested Methods of Instruction**

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

**Recommended Resources**

* Scientific Calculators
* Rulers, pencils, erasers
* Charts with presentations of data
* Graph books
* Dice
* Online resources
* Cartographic software

## LAND LAWS

**UNIT CODE:** LSM/CU/PRS/CC/06/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply Land Laws

**Duration of Unit:**  120 hours

**Unit Description**

This unit describes competencies required by a surveyor to identify land laws, verify land ownership, identify legal control over land use, demonstrate understanding of land registration, demonstrate understanding of cadastral processes, demonstrate understanding of land transactions, and arbitrate land disputes

**Summary of Learning Outcomes**

1. Identify land laws
2. Verify land ownership
3. Identify legal control over land use
4. Demonstrate understanding of land registration
5. Demonstrate understanding of cadastral processes
6. Demonstrate understanding of land transactions
7. Arbitrate land disputes

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify land laws | * Terms in land laws * Sources of land laws   + Common law   + Constitution   + Statues * Types of land laws * Evolution of land laws in Kenya * Principles of land policy | * Written tests * Oral questioning * Assignments |
| 1. Verify land ownership | * Types of land ownership * Community land * Public land * Private land * Land Tenure systems * Free hold * Lease hold | * Written tests * Oral questioning * Assignments |
| 1. Identify legal control over land use | * Types of land use   + Agricultural   + Residential   + Industrial   + Commercial   + Recreation * Legal land control * Land control regulation * Land use conversion * Development and use of land regulation. * Importance of legal land controls | * Written tests * Oral questioning * Assignments |
| 1. Demonstrate understanding of land registration | * Land rights and interest * Importance of land registration * Land registration processes | * Written tests * Oral questioning * Assignments |
| 1. Demonstrate understanding of laws governing surveying processes | * Land adjudication act * Survey act * Physical planning act * Cities and urban | * Written tests * Oral questioning * Assignments |
| 1. Demonstrate understanding of land transactions | * Types of land transaction * Legal instruments of land transactions | * Written tests * Oral questioning * Assignments |
| 1. Demonstrate understanding of land disputes arbitration process | * Types of land disputes * Process of resolving land disputes. * Actors in land dispute arbitration * Role of a surveyor in land disputes resolution | * Written tests * Oral questioning * Assignments |

**Suggested Methods of Instruction**

* Group discussions
* Demonstration by trainer
* Exercises by trainee

**Recommended Resources**

* Land laws and statutes
* Online resources
* Stationery.

# CORE UNITS OF LEARNING

## AERIAL PHOTOGRAMMETRY

**UNIT CODE: LSM/CU/PRS/CR/01/6/A**

**Duration of Unit: 200 Hours**

**Relationship to Occupational Standards**

This unit addresses the unit of competency: conduct aerial photogrammetry.

**Unit Description**

Competencies include conduct a reconnaissance, perform flight planning, conduct flight mission, perform ground control, perform pre-marking and post-marking, perform aerial triangulation, perform model orientations and perform photogrammetric feature extraction and product compilations.

**Summary of Learning Outcomes**

1. Conduct a reconnaissance
2. Perform flight planning
3. Perform ground control
4. Perform pre-marking
5. Perform post-marking
6. Perform aerial triangulation
7. Perform model orientations
8. Perform photogrammetric feature extraction and product compilations

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Conduct a reconnaissance | * Meaning of reconnaissance * Objectives of reconnaissance * Importance of a reconnaissance * Identification of area of interests * Identification of existing control points * Establishment of new control points * Safety precautions | * Observation * Oral questioning * Written tests |
| 1. Perform flight planning | * + Introduction to flight planning   + Importance of flight planning   + Identification of project requirements   + Preparation of flight diagram * Photo scale * Coordinate system * End lap and side lap * Spacing of the flight lines * Number of photographs   + Factors to be considered in flight planning * Map specification * Scale * Contour interval * Detail plotting * Nature of the terrain * Project area and orientation * Photography specifications * Photo scale * Weather conditions * Selecting instruments and procedures * Camera type and accessories * Type of aircraft * Type of plotter   + Flight time   + Estimating costs and delivery schedules * Materials * Personnel * logistics | * Oral questioning * Written tests * Practical assessments * Observation |
| 1. Perform ground control | * Ground control requirements * Horizontal control * Vertical control | * Observation * Oral questioning * Written tests * Practical Tests |
| 1. Perform pre-marking | * + Identification of pre-mark Locations   + Placement of targets on the identified locations   + Determination of coordinates of the pre-marked target | * Observation * Oral questioning * Practical Tests * Written tests |
| 1. Perform post-marking | * + selection of post-marks   + identification of selected post-marks   + preparation of sketch diagrams   + determination of coordinates of the post-mark | * Observation * Oral questioning * Written tests * Practical Tests |
| 1. Perform aerial triangulation | * + Creation of project directory   + Importation of Camera data, GPS/IMU data and photographs into photogrammetric software   + Measurement and transfer of Tie points   + Identification and measurement of ground control points   + Adjustment of aerial triangulation * Conduct Quality control process | * Observation * Oral questioning * Written tests * Practical Tests |
| 1. Perform model orientations | * + Perform inner orientation * Preparation of diapositive * Compensation of image distortiation * Cantering of diapositive in the projectors * Setting off the proper principal distance in the projector * Define focal length * Camera Lens distortion * Define Principal point   + Perform Relative orientation * Define camera attitude and position to create a model * Perform Absolute orientation and position * Relate model to ground space   + Perform Quality check | * Observation * Oral questioning * Written tests * Practical Tests |
| 1. Perform photogrammetric feature extractions and product compilations | * + Determine types of photogrammetric features required   + Perform feature extraction   + Methods of feature extraction   + Compilation of photogrammetric products | * Observation * Oral questioning * Written tests * Practical Tests |

**Suggested Methods of Instruction**

* Teaching
* Demonstration by trainer
* Practical work by trainee
* Demonstration videos
* Projects
* Group projects
* Industrial attachment
* Internship

**Recommended Resources**

* Survey and photogrammetric equipments and tools
* Survey data plans
* CAD and photogrammetric software
* Computers
* Stationery
* Online resources
* Storage media
* Transportation
* Store
* Photogrammetric lab
* Reference Text Books

## CLOSE-RANGE PHOTOGRAMETRY

**UNIT CODE: LSM/OS/PRS//CR/02/6/A**

**Duration of Unit:200 Hours**

**Relationship to Occupational Standards**

This unit covers the competencies required to: conduct close-range photogrammetry.

**Unit Description**

Competencies include; conduct a reconnaissance, conduct terrestrial image acquisition, perform ground control, perform image orientation, perform image triangulation, perform feature extraction and product compilation.

**Summary of Learning Outcomes**

1. Conduct a reconnaissance
2. Perform ground control
3. Conduct terrestrial image acquisition
4. Perform model orientations
5. Perform photogrammetric product extractions and compilation

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Conduct a reconnaissance | * Meaning of reconnaissance * Objectives of reconnaissance * Importance of a reconnaissance * Identification of existing control points * Safety precautions | * Observation * Oral questioning * Practical Tests |
| 1. Perform ground control | * Monumentation of control points * Establishment of new control points * Horizontal * vertical controls * methods of control | * Observation * Oral questioning * Written tests * Practical assessments |
| 1. Conduct terrestrial image acquisition | * + Preparation reflective targets   + Calibration of Camera parameters   + Establishment of camera stations   + Equipment setup   + Image acquisition and quality control * Image pre-processing | * Observation * Oral questioning * Written tests * Practical Tests |
| 1. Perform model orientations | * + Perform inner orientation * Preparation of diapositive * Compensation of image distortiation * Cantering of diapositive in the projectors * Setting off the proper principal distance in the projector * Define focal length * Camera Lens distortion * Define Principal point   + Perform Relative orientation * Define camera attitude and position to create a model * Perform Absolute orientation and position * Relate model to ground space * Perform Quality check | * Observation * Oral questioning * Written tests * Drawings * Practical Tests |
| 1. Perform photogrammetric feature extractions and product compilations | * + Determine types of photogrammetric features required   + Perform feature extraction   + Methods of feature extraction * Compilation of photogrammetric products | * Observation * Oral questioning * Written tests * Practical Tests |

Suggested Methods of Instruction

* Teaching
* Demonstration by trainer
* Practical work by trainee
* Demonstration videos
* Projects
* Group projects
* Industrial attachement
* Internship

**Recommended Resources**

* Survey and photogrammetric equipments and tools
* Survey data plans
* CAD and photogrammetric software
* Computers
* Stationery
* Online resources
* Storage media
* Transportation
* Store
* Photogrammetric lab
* Reference Text Books

## DIGITAL PHOTOGRAMMETRY

**UNIT CODE: LSM/OS/PRS//CR/03/6/A**

**Duration of Unit:200 Hours**

**Relationship to Occupational Standards**

This unit covers the competencies required to: conduct digital photogrammetry.

**Unit Description**

Competencies include: conduct a reconnaissance, conduct photogrammetric digital image acquisition, Conduct LiDar data acquisition, perform image processing, perform project setup, perform model orientations and perform bundle adjustment

**Summary of Learning Outcomes**

1. Conduct a reconnaissance
2. Conduct photogrammetric digital image acquisition
3. Perform ground control
4. Conduct LiDar data acquisition
5. Perform image processing
6. Perform project setup
7. Perform model orientations
8. Perform block triangulation and adjustment
9. Perform photogrammetric product extractions and compilations

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Conduct a reconnaissance | * Meaning of reconnaissance * Objectives of reconnaissance * Importance of a reconnaissance * Identification of existing control points * Safety precautions | * Observation * Oral questioning * Practical Tests * Written test |
| 1. Perform ground control | * Monumentation of control points * Establishment of new control points * Horizontal * vertical controls * methods of control | * Observation * Oral questioning * Written tests * Practical assessments |
| 1. Conduct photogrammetric digital image acquisition | * Photogrammetric tools and equipment * photogrammetric techniques and methods * types and formats of digital images * sources of digital imagery conversion from analog * direct acquisition using CCDS and or CMOS * digital image acquisition procedures * storage of digital images * compression of images * image transmission * image sharing formats | * Observation * Oral questioning * Written tests * Practical assessments |
| 1. Conduct LiDar data acquisition | * + Mission planning   + Processing of Lidar data   + Classification of cloud points * Digital terrain modelling and surface interpolation | * Observation * Oral questioning * Written tests * Practical Tests * Computation check |
| 1. Perform image processing | * + Methods of image processing   + Geometric and radiometric corrections | * Observation * Oral questioning * Written tests * Practical Tests |
| 1. Perform project setup | * + Creation of Working directory   + Image sensor type   + Projection of coordinate system | * Observation * Oral questioning * Sketches and drawing * Practical Tests |
| 1. Perform model orientations | * + Perform inner orientation * Preparation of diapositive * Compensation of image distortiation * Cantering of diapositive in the projectors * Setting off the proper principal distance in the projector * Define focal length * Camera Lens distortion * Define Principal point   + Perform Relative orientation * Define camera attitude and position to create a model * Perform Absolute orientation and position * Relate model to ground space * Perform Quality check | * Observation * Oral questioning * Written tests * Practical Tests |
| 1. Perform image matching | * + Techniques of image matching * Area-based * Feature-based * Relation-based | * Observation * Oral questioning * Written tests * Practical Tests |
| 1. Perform block triangulation and adjustment | * + Measurement of Tie points   + Ground control and check points * Adjustment is performed as per project requirements | * Observation * Oral questioning * Written tests * Practical Tests |
| 1. Perform photogrammetric feature extractions and product compilations | * + Determine types of photogrammetric features required   + Perform feature extraction   + Methods of feature extraction   + Compilation of photogrammetric products | * Observation * Oral questioning * Written tests * Practical Tests |

**Suggested Methods of Instruction**

* Teaching
* Demonstration by trainer
* Practical work by trainee
* Demonstration videos
* Projects
* Group projects
* Industrial attachement
* Internship

**Recommended Resources**

* Survey and photogrammetric equipments and tools
* Survey data plans
* CAD and photogrammetric software
* Computers
* Stationery
* Online resources
* Storage media
* Transportation
* Store
* Photogrammetric lab
* Reference Text Books

## TOPOGRAPHIC MAPPING

**UNIT CODE: LSM/OS/PRS//CR/04/6/A**

**Relationship to Occupational Standards**

This unit covers the competencies required to :conduct topographic mapping.

**Duration of Unit:200 Hours**

**Unit Description**

This unit covers the competencies required to conduct topographic mapping. Competencies include: conduct a reconnaissance, apply photogrammetric data, apply coordinate reference systems, apply map projections, apply cartographic principles, produce topographic maps and perform storage and archiving

**Summary of Learning Outcomes**

1. Conduct a reconnaissance
2. Apply photogrammetric data
3. Apply coordinate reference systems
4. Apply map projections
5. Apply cartographic principles
6. Produce topographic maps
7. Perform storage and archiving

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Conduct a reconnaissance | * Meaning of reconnaissance * Objectives of reconnaissance * Importance of a reconnaissance * Safety precautions | * Observation * Oral questioning * Practical Tests |
| 1. Apply photogrammetric data | * + Principles of **photogrammetric data**   + sources of image data   + Properties of image   + Spatial reference systems   + Process of obtaining ground control for photogrammetric mapping | * Observation * Oral questioning * Written tests * Practical assessments |
| 1. Apply coordinate reference systems | * + Identification of coordinate reference system * Coordinate transformation system | * Observation * Oral questioning * Written tests/ sketches |
| 1. Apply map projections | * + Map projections types   + Application of Map projections   + Map projection properties | * Observation * Oral questioning * Written tests/drawings and sketches * Practical Tests |
| 1. Apply cartographic principles | * + Identification of drawingequipment, media and inks   + Preparation of drawing equipment and media   + Application of mapping scale * Construction of rectangular grid | * Observation * Oral questioning * Written tests/drawings and sketches * Practical Tests |
| 1. Produce topographic maps | * + Preparation of map sheet (grids)   + Plotting of features   + Generation of contours * Map design | * Observation * Oral questioning * Written tests/drawings and sketches * Practical Tests |
| 1. Perform storage and archiving | * + Identification of storage media   + Compression of Data   + Preparation of Metadata * Data cataloguing | * Observation * Oral questioning * Written tests/drawings and sketches * Practical Tests |

**Suggested Methods of Instruction**

* Teaching
* Demonstration by trainer
* Practical work by trainee
* Demonstration videos
* Projects
* Group discussions
* Group projects
* Industry based learning

**Recommended Resources**

* Survey and photogrammetric equipments and tools
* Survey data plans
* CAD and photogrammetric software
* Computers
* Stationery
* Online resources
* Storage media
* Transportation
* Store
* Photogrammetric lab
* Reference Text Books

## REMOTE SENSING PROJECTS

**UNIT CODE: LSM/OS/PRS//CR/05/6/A**

**Relationship to Occupational Standards**

This unit covers the competencies required to conduct remote sensing projects.

**Duration of Unit: 200 Hours**

**Unit Description**

This unit covers the competencies required to conduct remote sensing projects. Competencies include: conduct a reconnaissance, identify energy source or illumination, identify radiation and atmosphere interaction, identify radiation interaction target, record energy sensor, conduct image processing, conduct image interpretation and analysis, identify application and perform product compilation

**Summary of Learning Outcomes**

* + 1. Conduct a reconnaissance
    2. Identify energy source or illumination
    3. Identify radiation and atmosphere interaction
    4. Identify radiation interaction target
    5. Record energy sensor
    6. Conduct image processing
    7. Conduct image interpretation and analysis
    8. Identify application
    9. Perform product compilation

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | Content | **Suggested Assessment Methods** |
| 1. Conduct a reconnaissance | * Meaning of reconnaissance * Objectives of reconnaissance * Importance of a reconnaissance * Safety precautions | * Observation * Oral questioning * Practical Tests |
| 1. Identify energy source or illumination | * Types of energy source * electromagnetic radiation principles | * Observation * Oral questioning * Written tests * Practical assessments |
| 1. **Identify radiation and atmosphere interaction** | * Energy interaction with the atmosphere * Scattering * Absorption | * Observation * Oral questioning * Written tests/ sketches |
| 1. **Identify radiation interaction target** | * Energy interaction with the target * Reflection * Absorption * Transmission | * Observation * Oral questioning * Written tests/drawings and sketches * Practical Tests |
| 1. **Recording of energy by the sensor** | * + Techniques of image acquisition   + Types of sensors and platforms   + Classification of sensor   + Image acquisition   + Types of images | * Observation * Oral questioning * Written tests/drawings and sketches * Practical Tests |
| 1. **Conduct image processing** | * Pre-processing * Image enhancement * Image segmentation * Image classification | * Observation * Oral questioning * Written tests/drawings and sketches * Practical Tests |
| 1. **Conduct image interpretation and analysis** | * + Elements of visual interpretation   + Digital image interpretation   + Extraction of analyzed information | * Observation * Oral questioning * Written tests/drawings and sketches * Practical Tests |
| 1. **Identify application** | * Application of remote sensing | * Observation * Oral questioning * Written tests/drawings and sketches * Practical Tests |
| 1. Perform product compilation | * + Types of remote sensing products   + Extraction of remote sensing products   + Compilation of remote sensing products | * Observation * Oral questioning * Written tests/drawings and sketches * Practical Tests |

**Suggested Methods of Instruction**

* Teaching
* Demonstration by trainer
* Practical work by trainee
* Demonstration videos
* Projects
* Group discussions
* Group projects
* Industry based learning

**Recommended Resources**

* Survey and photogrammetric equipments and tools
* Survey data plans
* CAD and photogrammetric software
* Computers
* Stationery
* Online resources
* Storage media
* Transportation
* Store
* Photogrammetric lab
* Reference Text Books

## SATELLITE PHOTOGRAMMETRY

**UNIT CODE: LSM/OS/PRS//CR/06/6/A**

**Relationship to Occupational Standards**

This unit covers the competencies required to: conduct satellite photogrammetry. **Duration of Unit:200 Hours**

**Unit Description**

Competencies include: conduct a reconnaissance, apply stereoscopic satellite imagery, perform ground control, perform project setup, perform photogrammetric model setup and perform product compilation

**Summary of Learning Outcomes**

1. Conduct a reconnaissance
2. Apply stereoscopic satellite imagery
3. Perform ground control
4. Perform project setup
5. Perform photogrammetric model setup
6. Perform product compilation

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Conduct a reconnaissance | * Meaning of reconnaissance * Objectives of reconnaissance * Importance of a reconnaissance * Safety precautions | * Observation * Oral questioning * Practical Tests |
| 1. Apply stereoscopic satellite imagery | * Types of satellites for stereoscopic satellite imagery * Type of stereoscopic images | * Observation * Oral questioning * Written tests * Practical assessments |
| 1. Perform ground control | * Monumentation of control points * Types of monuments * Establishment of new control points * Horizontal * vertical controls * methods of control points establishment | * Observation * Oral questioning * Written tests/ sketches |
| 1. Perform project setup | * + Creation of Working directory   + Image sensor type   + Projection of coordinate system | * Observation * Oral questioning * Written tests/drawings and sketches * Practical Tests |
| 1. Perform photogrammetric model setup | * + Perform inner orientation   + Perform Relative orientation   + Perform Absolute orientation and position * Perform Quality check | * Observation * Oral questioning * Written tests * Practical assessments |
| 1. Perform product compilation | * + Types of image products   + Extraction of image features and products   + Compilation of image products | * Observation * Oral questioning * Written tests * Practical assessments |

**Suggested Methods of Instruction**

* Teaching
* Demonstration by trainer
* Practical work by trainee
* Demonstration videos
* Projects
* Group discussions
* Group projects
* Industry based learning

**Recommended Resources**

* Survey and photogrammetric equipments and tools
* Survey data plans
* CAD and photogrammetric software
* Computers
* Stationery
* Online resources
* Storage media
* Transportation
* Store
* Photogrammetric lab
* Reference Text Books