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**TVET CURRICULUM DEVELOPMENT, ASSESSMENT AND CERTIFICATION COUNCIL (TVET CDACC)**

**COMPETENCY-BASED CURRICULUM**

**FOR**

**CONSTRUCTION SURVEYOR**

**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. 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 Construction 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 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 Construction Sector Skills Advisory Committee (SSAC) have developed this curriculum for Construction Surveying.

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

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

**CHAIRMAN, 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 organisations.

I appreciate the funding of the Government of Canada and its implementing partner Colleges and Institutes Canada (CICan) which enabled the development of this curriculum through the Kenya Education for Employment Program (KEFEP).

I also appreciate the Eldoret National Polytechnic and its Canadian technical partners from Algonquin College who collaborated to identify industry skills gaps and develop this curriculum.

I recognize with appreciation the role of industry partners including the National Polytechnic’s Industry Advisory Committee and the national Sector Skills Advisory Committee (SSAC) in ensuring that competencies required by the industry are addressed in the curriculum. I also thank all stakeholders in the 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 this sector acquire competencies that will enable them to perform their work more efficiently.

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

**COUNCIL SECRETARY/CEO**

**TVET CDACC**

# ACRONYMS

CBET Competency Based Education and Training

CDACC Curriculum Development Assessment and Certification Council

EDM Electronic Distance Machine

OS Occupational Standard

OSHS Occupational Safety and Health Standards

PPE Personal Protective Equipment

SSAC Sector Skills Advisory Committee

TVET Technical and Vocational Education and Training

# KEY TO UNIT CODE

**ENG/CU/CS/BC/01/4/A**

Industry or sector

Curriculum

Occupational area

Type of competency

Competency number

Competency level

Version control

# COURSE DESCRIPTION

This course overview describes the competencies required for employment as a CONSTRUCTION SURVEYOR LEVEL 4. The course is designed to equip the trainee with competencies related to the practical application of survey theory and skills to construction work, the use of a variety of survey tools and their application to surveying and the use of electronic distance machines. Topics include tachometry, use of total stations, earthworks, setting out works, mapping and GPS. Trainees engage in a summative survey project. Completion of this program qualifies the graduate to work as a Construction Surveyor with all the required competencies.

**Units of Learning**

This course consists of basic and core units of learning as indicated below:

**Basic units of competency**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit factors** |
| ENG/CU/CS/BC/01/4/A | Communication Skills | 20 | 2 |
| ENG/CU/CS/BC/02/4/A | Numeracy skills | 80 | 8 |
| ENG/CU/CS/BC/03/4/A | Digital Literacy | 80 | 8 |
| ENG/CU/CS/BC/04/4/A | Entrepreneurial Skills | 60 | 6 |
| ENG/CU/CS/BC/05/4/A | Employability Skills | 30 | 3 |
| ENG/CU/CS/BC/06/4/A | Environmental Literacy | 20 | 2 |
| ENG/CU/CS/BC/07/4/A | Occupational Safety and Health Practices | 20 | 2 |
| **Total** | | **310** | **21** |

|  |  |  |  |
| --- | --- | --- | --- |
| **Core Units of Learning** | | |  |
| **Unit of Learning Code** | **Unit of Learning Title** | **Duration in Hours\*** | **Credit Factors** |
| ENG/CU/CS/CR/01/4/A | Construction Survey Site Preparation | 120 | 12 |
| ENG/CU/CS/CR/02/4/A | Construction Surveyor Assistant | 120 | 12 |
| ENG/CU/CS/CR/03/4/A | Construction Surveyor | 120 | 12 |
|  | Industry/Work Attachment | 300 | 30 |
| **Total** | | **660** | **66** |
| **Grand Total** | | **980** | **98** |

**\*Hours as noted are notional hours and include classroom, lab, self-study, and assignment time.**

**Basic Units of Learning**

**Entrepreneurial Skills (delivered as a separate unit)**

1. Describe concepts of entrepreneurship
2. Describe concepts of the entrepreneur
3. Developing entrepreneurial opportunities
4. Starting a small business
5. Managing small enterprises
6. Exploring enterprise social responsibilities
7. Developing a business plan
8. Information and communication technology in entrepreneurship
9. Recognizing emerging trends in entrepreneurship

**Communication Skills (embedded with core competency curriculum delivery)**

1. Utilize specialized communication skills processes
2. Develop communication strategies
3. Establish and maintain communication pathways
4. Promote use of communication strategies
5. Facilitate group discussion

**Numeracy Skills (delivered as a separate unit)**

1. Apply the concepts of indices
2. Apply a range of algebraic calculations
3. Apply geometry and scale drawings
4. Apply graphs and graphing functions
5. Apply a range of trigonometric calculations
6. Use latitudes and longitudes
7. Coordinate geometry and loci
8. Apply principles of mensuration
9. Use vectors
10. Apply concepts of probability and statistics
11. Use and apply differential calculus principles
12. Use and apply the concepts of integral calculus
13. Use and apply concepts of numerical methods
14. Identify and apply the fundamentals of Statics

**Digital Literacy Skills (delivered as a separate unit)**

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. Set up the drawing environment in CAD software for drawings
5. Draw and edit simple drawings using CAD software
6. Apply annotation to CAD drawings
7. Assign and manage object properties in CAD software
8. Plot a drawing using CAD software
9. Create and use a personalized template using CAD software
10. Generate and manage Wblocks using CAD software

**Employability Skills (embedded with core competency curriculum delivery)**

1. Develop self-awareness and ability to deal with life challenges
2. Demonstrate critical safe work habits for employees
3. Lead a workplace team
4. Plan and organize work
5. Demonstrate learning, creativity and innovativeness in the workplace

**Environmental Literacy (embedded with core competency curriculum delivery)**

1. Control environmental hazard
2. Control environmental Pollution
3. Demonstrate sustainable resource use
4. Identify Environmental legislations/conventions for environmental concerns

**Occupational Safety and Health Practices (embedded with core competency curriculum delivery)**

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

**CORE COMPETENCIES (as per the Occupational Standard)**

1. Conduct field surveys and operate survey instruments and computer equipment to measure distance, angles, elevations and contours.
2. Record and assist calculation, analysis and computation in the measurements and other information obtained during field survey activities.
3. Determine precise geographic locations using global positioning systems (GPS) equipment.
4. Analyze latitude, longitude and angles and compute trigonometric and other calculations to plot features, contours and areas to a specific scale.
5. Keep records, measurements and other survey information in systematic order.
6. Assist in the preparation of detailed drawings, charts and plans.

**Entry Requirements**

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

1. Kenya Certificate of Secondary Education (KCSE): Mean Grade E

**Or**

1. Equivalent qualifications 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 the responsibility of TVET CDACC.

**Certification**

A candidate will be issued with a Record of Achievement for each unit of competency. To attain the qualification National Certificate Level 4 in Construction Surveying 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:** ENG/CU/CS/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. Communicate information about workplace processes
2. Lead workplace discussion
3. Identify and communicate issues arising in the workplace

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 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:** ENG/CU/CS/BC/02/4/A

**Relationship to Occupational Standards:** This unit addresses the unit of competency: Demonstrate numeracy skills relevant to the Construction Surveyor (level 4).

**Duration of Unit:** 80 hours

**UNIT DESCRIPTION**

This unit describes the competencies required by a construction surveyor, a concrete field testing technician, and a concrete construction foreperson (level 4/5) in order to apply a wide range of mathematical calculations. It involves: apply a range of algebraic trigonometric, differential calculus calculations, geometry and scale drawings, graphing functions, and latitudes/longitudes, principles of mensuration, vectors and differential equations, and concepts of probability and statistics and numerical methods.

**Summary of Learning Outcomes**

1. Apply the concepts of indices
2. Apply a range of algebraic calculations
3. Apply geometry and scale drawings
4. Apply graphs and graphing functions
5. Apply a range of trigonometric calculations
6. Use latitudes and longitudes
7. Coordinate geometry and loci
8. Apply principles of mensuration
9. Use vectors
10. Apply concepts of probability and statistics
11. Use and apply differential calculus principles
12. Use and apply the concepts of integral calculus
13. Use and apply concepts of numerical methods
14. Identify and apply the fundamentals of Statics

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Apply the concepts of indices | * Powers * Laws of indices * Indices operations/logarithms | * Oral questioning * Assignments-individual/group * Supervised exercises |
| 1. Apply a range of algebraic calculations | * Algebraic expressions * Operations of algebraic expressions * Factorization of algebraic expressions * Simultaneous equations * Linear with 2 unknowns * Linear with 3 unknowns * Linear and quadratic * Transposition of formulae | * Oral questioning * Written tests/quizzes * Assignments-individual/group * Supervised exercises |
| 1. Apply geometry and scale drawings | * Scales * Drawing basic figures plane * Drawing of solids | * Written tests/quizzes * Oral questioning * Assignments-individual/group * Supervised exercises |
| 1. Apply graphs and graphing functions | * Linear * Quadratic * Solution of equations * Linear and quadratic * Tangents * Determination of laws | * Oral questioning * Assignments- individual/group * Supervised exercises * Practical tests |
| 1. Apply a range of trigonometric calculations | * Angles * Radian measure * Minutes and seconds * Trigonometric ratios and their reciprocals * Angles of elevation and depression * Sine rule * Cosine rule * Solution of triangles * Graphs of trigonometric functions | * Oral questioning * Assignments- individual/group * Supervised exercises * Practical tests |
| 1. Use latitudes and longitudes | * Latitudes and longitudes * The equator and the Greenwich median * Distance between two points along small and great circles * Time between longitude * Speed | * Oral questioning * Assignments- individual/group * Supervised exercises * Practical tests |
| 1. Coordinate geometry and loci | * Polar equations * Conversion of Cartesian to polar and vice versa * Graphs of polar equations * Definitions of locus in relation points, lines, planes, ellipses, parabola, hyperbola | * Oral questioning * Assignments- individual/group * Supervised exercises * Practical tests |
| 1. Apply principles of mensuration | * Units of measurement * Perimeter and areas of regular figures * Volume of regular solids * Surface areas of regular solids * Area of irregular figures * Area and volumes using Pappus theorem | * Oral questioning * Assignments- individual/group * Supervised exercises * Practical tests |
| 1. Use vectors | * Vectors and scalar in two and three dimensions * Operations on vectors: addition and subtraction * Position vectors * Resolution of vectors * Scalar product | * Oral questioning * Assignments- individual/group * Supervised exercises * Practical tests |
| 1. Apply concepts of probability and statistics | * Definitions * Laws of probability * Mutually exclusive, independent events, conditional probability, * Tree diagram, sample point, Venn diagram * Data arrangement * Representation of data * Measures of central tendency * Measures of dispersion | * Oral questioning * Assignments- individual/group * Supervised exercises * Practical tests |
| 1. Use and apply principles of differential calculus | * Define differentiation * Differentiate from first principles * Use standard deviations in solving surveying problems * State the rules of differentiation * Apply the rules of differentiation to find derivatives of trigonometric, logarithmic and exponential function * Differentiate polynomials * Find higher derivatives of functions * Determine derivatives of implicit functions * Find derivatives of parametric functions * Apply differentiation * Find partial derivatives * Introduce ordinary differential equations (first and second order) | * Oral questioning * Assignments- individual/group * Supervised exercises * Practical tests |
| 1. Use and apply the concepts of integral calculus | * Define integration * Deduce integration by reverse differentiation * Solve problems involving standard integrals * Evaluate definite integrals * Integrate functions using different methods * Deuce reduction formulae * Apply reduction formulae to determine integrals * Apply integration | * Oral questioning * Assignments- individual/group * Supervised exercises * Practical tests |
| 1. Use and apply concepts of numerical methods | * Definition of interpolation and extrapolation * Application of interpolation and extrapolation | * Oral questioning * Assignments- individual/group * Supervised exercises * Practical tests |
| 1. Identify and apply the fundamentals of Statics | * Evaluate the moment (turning action) of a system of plane forces * Demonstrate and apply the concept of equilibrium to the evaluation of support forces and internal actions in simple, determinate systems * Apply the concept of equilibrium for the analysis of simple, determinate, structural systems * Demonstrate and understanding of the concept of dry, static friction and the process of evaluating contact force between two bodies | * Oral questioning * Assignments- individual/group * Supervised exercises * Practical tests |

**Suggested Delivery Methods**

* Group discussions
* Demonstration by trainer
* Practical work by trainee
* Exercises applied to surveying

**Recommended Resources**

* Calculators
* Rulers, pencils, erasers
* Charts with presentations of data
* Graph books
* Internet
* Instructional Equipment as follows:
  + Overhead projector
  + Projector Screen
  + Instructor desktop PC
  + Whiteboard(s)

# DIGITAL LITERACY SKILLS

**UNIT CODE:** ENG/CU/CS/BC/03/4/A

**Relationship to Occupational Standards:** This unit addresses the Unit of Competency: Demonstrate digital literacy relevant to Construction Surveying (level 4).

**Duration of Unit:** 80 hours

**UNIT DESCRIPTION**

This unit describes competencies required to use a computer and computer aided design (CAD) software (AutoCAD, ArchiCAD, etc.) related to the construction surveying and concrete construction field(s) for the purposes of communication and work performance at the workplace.

**Summary of Learning Outcomes**

1. Identify computer hardware and software
2. Apply security measures to data, hardware, software
3. Apply computer software in solving tasks
4. Set up the drawing environment in CAD software for drawings
5. Draw and edit simple drawings using CAD software
6. Apply annotation to CAD drawings
7. Assign and manage object properties in CAD software
8. Plot a drawing using CAD software
9. Create and use a personalized template using CAD software
10. Generate and manage Wblocks using CAD software

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify computer hardware and software | * Concepts and functions of ICT * Components of a computer * Introduction to Computer Aided Design (CAD) software | * Written tests * Oral presentation * Observation |
| 1. Apply security measures to data, hardware and software | * Data security and control * Security threats and control measures * Types of computer crimes * Detection and protection against computer crimes * Laws governing protection of ICT | * Written tests * Oral presentation * Observation * Project |
| 1. Apply computer software in solving tasks | * Operating system * Word processing * Spread sheets * Data base design and manipulation * Data manipulation, storage and retrieval | * Oral questioning * Observation * Software assignment |
| 1. Set up the drawing environment in CAD software for drawings | * Start a new drawing with or without a template and open an existing drawing file * Choose correct settings for drawing units and precision * Set up drawing limits | * Oral questioning * Observation * Software assignment |
| 1. Draw and edit simple drawings using CAD software | * Choose and apply appropriate commands to create drawings * Choose and apply appropriate commands to edit drawings | * Oral questioning * Observation * Software assignment |
| 1. Apply annotation to CAD drawings | * Create annotative text styles and dimension style * Add annotation to drawings using personalized annotative styles, correct annotation scale(s) and basic text and dimension commands | * Oral questioning * Observation * Software assignment |
| 1. Assign and manage object properties in CAD software | * Create, assign and manage layer, colour and line type properties for objects | * Oral questioning * Observation * Software assignment |
| 1. Plot a drawing using CAD software | * Access Layout Space * Create and correctly scale viewport(s) in Layout Space * Apply correct annotation scale settings to viewport * Choose correct settings from the Plot Settings dialog box and apply the Plot command * Convert AutoCAD file to PDF (with layers) | * Oral questioning * Observation * Software assignment |
| 1. Create and use a personalized template using CAD software | * Design and save a personalized metric template as a .dwt file format * Employ a personalized Template to begin a new drawing | * Oral questioning * Observation * Software assignment |
| 1. Generate and manage Wblocks using CAD software | * Define and save Wblocks * Insert and re-define Wblocks | * Oral questioning * Observation * Software assignment |

**Suggested Delivery Methods**

* Instructor led facilitation of theory
* Demonstration by trainer in computer lab
* Practical, hands-on work by trainee in computer lab
* Viewing of related videos
* Softwaree assignemnts, individual and group
* Group discussions

**Recommended Resources**

* Desktop computers
* Laptop computers
* Computer Aided Design (CAD) software
* Printers
* Storage devices
* Internet access
* Computer software
* Instructional Equipment as follows:
  + Overhead projector
  + Projector Screen
  + Instructor desktop PC
  + Whiteboard(s)

# ENTREPRENEURIAL SKILLS

**UNIT CODE:** ENG/CU/CS/BC/04/4/A

**Relationship to occupational standards:** This unit addresses the unit of competency: Demonstrate entrepreneurial skills relevant to a Construction Surveyor (level 4).

**Duration of unit:** 60 hours

**UNIT DESCRIPTION**

This unit describes the competencies critical to demonstration of entrepreneurial aptitudes for a construction surveyor, a concrete field testing technician, and a concrete construction foreperson (level 4/5). It involves: understanding concepts of entrepreneurship and the entrepreneur, developing entrepreneurial opportunities, starting a small business, managing small enterprises, exploring enterprise social responsibility, developing a business plan, information and communication technology and emerging trends in entrepreneurship.

**Summary of Learning Outcomes**

1. Describe concepts of entrepreneurship
2. Describe concepts of the entrepreneur
3. Develop entrepreneurial opportunities
4. Starting a small business
5. Managing small enterprises
6. Recognizing enterprise social responsibilities
7. Developing a business plan
8. Information and communication technology in entrepreneurship
9. Recognizing emerging trends in entrepreneurship

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Describe concepts of entrepreneurship | * Definition of terms * Contributions of entrepreneurship towards national development * Self-employment versus salaried employment | * Observation * Case studies * Individual/group assignments * Projects– written/oral |
| 1. Describe concepts of the entrepreneur | * Myths associated with entrepreneurship * Types of entrepreneurs * Characteristics/traits of an entrepreneur * Roles of an entrepreneur in an enterprise | * Observation * Case studies * Individual/group assignments * Projects– written/oral |
| 1. Develop entrepreneurial opportunities | * Business ideas and idea generation * Sources of business ideas * Identification and evaluation of business opportunities * Matching competence with business opportunities | * Observation * Case studies * Individual/group assignments * Projects– written/oral |
| 1. Starting a small business | * Forms of business ownership * Factors associated with starting a small enterprise * Procedure of starting a small enterprise * Business life cycle * Challenges of starting a small enterprise * Resources for a business | * Observation * Case studies * Individual/group assignments * Projects– written/oral |
| 1. Managing small enterprises | * Definition and terms * Managing enterprise resources * Managing business finances * Managing business records * Business support services * Marketing activities in a small enterprise | * Observation * Case studies * Individual/group assignments * Projects-written/oral |
| 1. Recognizing enterprise social responsibilities | * Definitions and terms * Importance of enterprise social responsibility * Social concerns of an enterprise | * Observation * Case studies * Individual/group assignments * Projects-written/oral |
| 1. Developing a business plan | * Overview of a business plan * Components of a business plan * Creation of a business plan | * Observation * Case studies * Individual/group assignments * Projects- written |
| 1. Information and communication technology in entrepreneurship | * Benefits of Information and communication technology to a small enterprise * Use of computer applications software in a small business | * Observation * Case studies * Individual/group assignments * Projects using computer and software |
| 1. Recognizing emerging trends in entrepreneurship | * Emerging trends in enterprise management * Challenges posed by emerging trends and issues * Management of challenges posed by emerging trends and issues in entrepreneurship | * Observation * Case studies * Individual/group assignments * Projects- written/oral |

**Suggested Delivery Methods**

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

**Recommended Resources**

* Case studies for small businesses
* Business plan templates
* Laptop/ desktop computers
* Internet
* Telephone
* Writing materials
* Instructional Equipment as follows:
  + Overhead projector
  + Projector Screen
  + Instructor desktop PC
  + Whiteboard(s)

# EMPLOYABILITY SKILLS

**UNIT CODE:** ENG/CU/CS/BC/05/4/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 competencies for exuding self-awareness and ability to deal with everyday life challenges; applying critical safe work habits and working harmoniously in a team; participating in planning and organizing work activities; applying learning, creativity and innovativeness in workplace functions; pursuing professional growth and managing time effectively in the workplace.

**Summary of Learning Outcomes**

1. Develop self-awareness and ability to deal with life challenges
2. Demonstrate critical safe work habits for employees
3. Demonstrate workplace teamwork
4. Plan and organize work activities
5. Maintain professional growth and development in the workplace.
6. Demonstrate learning, creativity and innovativeness in the workplace.

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Develop self-awareness and ability to deal with life challenges | * Formulating personal goals and objectives * Acquiring and maintaining a positive self-image * Ways for overcoming life challenges * Self esteem * Handling emotions * Emotional intelligence * Expressing personal feelings and beliefs * Methods of sharing personal feelings * Monitoring and evaluating ones performance * Setting performance targets * Asserting one-self * Articulating ideas * Accountability | * Observation * Written * Oral/interview * Third party report |
| 1. Demonstrate critical safe work habits for employees | * Stress and stress management * Punctuality and time consciousness * Safety in the workplace * Integratingpersonal objectives into organizational objectives * Resources utilization * Setting work priorities * Developing relationships * Leisure * HIV and AIDS * Drug and substance abuse * Dealing with emerging issues | * Observation * Written * Oral interview * Third party report |
| 1. Demonstrate workplace teamwork | * Determination of team roles and objectives * Identifying Team parameters and relationships * Team work * Identifying individual responsibilities in a team * Conflicts and their resolution * Communication * Complementing team activities * Gender * Human rights protocols * Relationships * Group dynamics | * Observation * Oral interview * Written * Third party report |
| 1. Plan and organize work activities | * Making work schedules * Time concept * Time management * identifying work goals/objectives and deliverables * Maintaining work records * Resource utilization * Decision making * Problem solving * Negotiation | * Observation * Oral interview * Written * Third party report |
| 1. Maintain professional growth and development in the workplace | * Identifying training needs * Training and career opportunities * Licenses and certifications for professional growth and development * Pursuing personal and organizational goals * Managing work priorities and commitments * Recognizing of career advancement | * Observation * Oral interview * Written * Third party report |
| 1. Demonstrate learning, creativity and innovativeness in the workplace | * Managing own learning * Networking * Variety of learning context * Application of learning * Safe use of technology * Taking initiative/proactivity * Flexibility * Identifying opportunities * Workplace innovation * Performance improvement | * 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:** ENG/CU/CS/BC/06/4/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:** ENG/CU/CS/BC/07/4/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 in arrangements 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 vest

# CORE UNITS OF LEARNING

# CONSTRUCTION SURVEYING SITE PREPARATION

**UNIT CODE:** ENG/CU/CS/CR/01/4/A

**Duration of Unit:** 120 hours

**Relationship to Occupational Standards**: This unit addresses Core Competencies 2, 4, 5, and 6:

2. Record and assist calculation, analysis and computation in the measurements and other information obtained during field survey activities

4. Analyze latitude, longitude and angles and compute trigonometric and other calculations to plot features, contours and areas to a specific scale

5. Keep records, measurements and other survey information in systematic order

6. Assist in the preparation of detailed drawings, charts and plans

**UNIT DESCRIPTION**

This unit describes the introductory competencies required by a CONSTRUCTION SURVEYOR in order to competently use a variety of survey tools and their application to surveying, field work and in-class discussion. Focus is on surveys in common use, levelling and survey control lines and in acquiring the skills and competencies required to assist a Construction Surveyor in preparing a construction site for surveying and, under the supervision of the Construction Surveyor or Surveyor Assistant, performing basic surveying tasks such as placing survey control lines.

**Summary of Core Competency Learning Outcomes for the Construction Site Preparation Unit**

1. Explain basic survey terminologies and fundamentals
2. Identify surveys in common use
3. Operate a survey level for a variety of survey exercises
4. Calculate the directions of survey control lines

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Explain basic survey terminologies and fundamentals. | * Define terms used in surveying and describe various types of surveys in common use. * Explain the objective of surveying. * State the typical accuracy of engineering and explain differences between systematic and random errors. * Locate distances a long a baseline. * Apply units of measurement that are commonly used in metric and imperial systems. * Calculate temperature correction for survey distances. * Explain the procedure for applying corrections for a tape and relate the significance of random taping errors. | * Written exams/tests * Group discussions * Individual/group assignments |
| 1. Identify surveys in common use. | * Explain various types of surveys in common use. * Describe and use tools and equipment used in survey operation. * Demonstrate and carry out various surveys. | * Observation * Individual/group presentations * Group discussions * Individual/group assignments * Field practice |
| 3. Operate survey levels for a variety of survey exercises. | * Define terms used in levelling * Explain tools and equipment used in levelling. * Set up and operate a variety of survey levels as required for various exercise and testing. * Outline the procedure of levelling and explain methods of reducing levels. * Describe the meaning and significance, calculate and adjust arithmetic errors in surveying. * Complete a set of level notes and graph results. | * Observation * Field Records/Notes |
| 4. Calculate the directions of survey control lines. | * Define and determine the direction of a survey line. * Calculate the directions of survey lines in a closed survey * Execute the standard check to ensure accuracy of results. | * Assignments * Field practice |

**Suggested Delivery Methods**

* Practical demonstration of tasks by trainer
* Practice by trainees
* Observations and comments and corrections by trainers
* Trainer led facilitation of theory
* Group/individual presentations

**Recommended Resources**

* Occupational Health and Safety standards
* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Organizational or external personnel
* Relevant professional/quality standards
* Instructional Equipment as follows:
  + Overhead projector
  + Projector Screen
  + Instructor desktop PC
  + Whiteboard(s)
* Tools and/or Equipment as follows:
* Electronic Distance Machine (EDM)
* Telescopic Leveling Rod/Staff
* Automatic Level
* Distance Measuring Wheel
* Hand Level
* Steel Band Measuring Tapes (10m,20m,30m,50m)
* Dumpy Level
* Ranging Rod
* Plumb Bob
* Field Notebook
* Surveying Marker Flags/Arrows
* Electronic Total Station Kit with Tripods
* Automatic Electronic Levels
* GPS Receiver
* Survey Compass
* Prismatic Compass
* Ranging Rod
* Levelling Staff
* Engineer's Multipurpose Tilting Level
* Robotic Total Stations
* Prism Pole
* Theodolite Kit
* Tripod
* Steel Band Tapes (10m,20m,30m,and 50m)
* Open Real Measuring Tapes
* Plotter
* Laptop
* AutoCAD/ArchiCAD or other relevant design software

# CONSTRUCTION SURVEYING ASSISTANT

**UNIT CODE:** ENG/CU/CS/CR/02/4/A

**Duration of Unit:** 120 hours

**Relationship to Occupational Standards**: This unit addresses Core Competencies 1, 2, 3, 4, 5, and 6:

1. Conduct field surveys and operate survey instruments and computer equipment to measure distance, angles, elevations and contours
2. Record and assist calculation, analysis and computation in the measurements and other information obtained during field survey activities
3. Determine precise geographic locations using global positioning systems (GPS) equipment
4. Analyze latitude, longitude and angles and compute trigonometric and other calculations to plot features, contours and areas to a specific scale
5. Keep records, measurements and other survey information in systematic order
6. Assist in the preparation of detailed drawings, charts and plans

**UNIT DESCRIPTION**

This unit describes the competencies required by a construction surveyor in order to competently demonstrate the practical application of survey theory and skills to the construction field. Successful completion of this unit will provide the skills and competencies required to assist a Construction Surveyor as a Construction Surveyor Assistant in the performance of more advanced surveying tasks such as curve ranging, traversing, and road-way elevations.

**Summary of Learning Outcomes**

1. Demonstrate an understanding of curve ranging, definition of terms and describe tools and equipment being used, and perform calculations on curve ranging and super elevation.
2. Demonstrate an understanding of terms and tools used in traversing and perform calculations related to traversing,

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Demonstrate an understanding of curve ranging, definition of terms and describe tools and equipment being used, and perform calculations on curve ranging and super elevation. | * Define various terms used in curve ranging. * Explain the purpose of curve ranging. * Describe tools and equipment’s for curve ranging. * Outline and calculate data for curve ranging and explain various methods of overcoming obstacles in curve ranging. * Calculate vertical curve elevations. * Calculate spiral curve deflectations. * Calculate road way super elevation. | * Exams/tests * Individual/group assignments |
| 2. Demonstrate an understanding of terms and tools used in traversing and perform calculations related to traversing. | * Define terms used in traversing. * Explain various instrumental methods of traversing. * Describe and demonstrate various types of traversing. * Execute field procedure of traversing. * Explain the causes and adjustments of errors. | * Observation * Field work * Field work reports |

**Suggested Delivery Methods**

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

**Recommended Resources**

* Occupational Health and Safety standards
* Standard operating and/or other workplace procedures manuals.
* Specific job procedures manuals
* Organizational or external personnel
* Relevant Quality standards
* Instructional Equipment as follows:
  + Overhead projector
  + Projector Screen
  + Instructor desktop PC
  + Whiteboard(s)
* Tools and/or Equipment as follows:
* Electronic Distance Machines (EDM)
* Telescopic Leveling Rod/Staff
* Automatic level
* Distance Measuring Wheels
* Hand Levels
* Steel Band Measuring Tapes(10m,20m,30m,50m)
* Dumpy Level
* Ranging rod
* Plumb Bob
* Field Notebook
* Surveying Marker Flags/Arrows
* Cross Staff/Optical Squares
* Electronic Total Station Kit with Tripods
* Automatic Electronic Levels
* Automatic Level
* GPS Receiver
* Survey Compass
* Prismatic Compass
* Ranging Rod
* Levelling Staff (digital)
* Engineer's Multipurpose Tilting Level
* Robotic Total Stations
* Prism Pole
* Theodolite Kit/Tachometer
* Tripod
* Open Real Measuring Tapes
* Telescopic Leveling Rod/Staff
* Laptop
* Plotter
* AutoCAD/ArchiCAD or other relevant design software

# CONSTRUCTION SURVEYOR

**UNIT CODE:** ENG/CU/CS/CR/03/4/A

**Duration of Unit:** 120 hours

**Relationship to Occupational Standards**: This unit addresses Core Competencies 1, 4, 6:

1. Conduct field surveys and operate survey instruments and computer equipment to measure distance, angles, elevations and contours

4. Analyze latitude, longitude and angles and compute trigonometric and other calculations to plot features, contours and areas to a specific scale

6. Assist in the preparation of detailed drawings, charts and plans.

**UNIT DESCRIPTION**

This unit describes the competencies required by a CONSTRUCTION SURVEYOR in order to competently demonstrate the practical application of survey theory and skills to construction work. Topics include tacheometry use of total stations earthworks, setting out works mapping and GPS. Trainees engage in summative project survey. Successful completion of this unit will provide the skills and competencies required to work in the field as a Construction Surveyor.

**Summary of Learning Outcomes**

1. Operate a theodolite in tacheometry survey and operate and use a total station
2. Apply surveying skills to control works
3. Apply survey skills in setting out construction works
4. Operate GPS receiver and use AutoCAD to draw maps
5. Survey a section of the campus as directed and produce site plan of the area

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Operate a theodolite in tacheometry surveys and operate and use a total station | * Explain principles of tacheometry. * Describe and use tools and equipment. * Outline the procedure of carrying out tacheometry. * Explain the key features and settings of the total station. * Set up and operate the optical and digital levels compute accurate bench mark level loops and to set grades. | * Observation * Field work * Field work manuals |
| 2. Apply surveying skills to control works. | * Draw and interpret mass haul diagrams. * Identify and use tools and equipment in control works. * Calculate areas and volumes | * Assignments * Tests |
| 3. Apply survey skills in setting out construction works | * Identify and operate tools and equipment required in setting out construction work. * Outline the procedure and apply it in construction works to include verticality of building. | * Observation * Field work - group * Field work manuals - individual |
| 4.Operate GPS receiver and use AutoCAD to draw maps | * Explain properties of maps. * State types of maps. * Analyse interrelationships between scales. * Use GPS receiver to determine horizontal coordinates of point. | * Observation * Field work - group * Field work manuals - individual |
| 5. Survey a section of the campus as directed and produce site plan of the area. | * Use the total station to survey topographical data required * Conduct a site reconnaissance of assigned compass area to identify object to be surveyed and site condition for planning the field work. * Draw a detail site plan of the area on AutoCAD. | * Observation * Field work – group * Field work manuals - individual |

**Suggested Delivery Methods**

* Practical demonstration of tasks by trainer
* Field practice by trainees
* Observations and comments and corrections by trainers
* Trainer led facilitation of theory

**Recommended Resources**

* Occupational Health and Safety standards
* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Organizational or external personnel
* Relevant professional/quality standards
* Instructional Equipment as follows:
  + Overhead projector
  + Projector Screen
  + Instructor desktop PC
  + Whiteboard(s)
* Tools and/or Equipment as follows:
  + Electronic Total Station Kit with Tripods
  + Automatic Electronic Levels
  + Automatic Level
  + GPS Receiver
  + Survey Compass
  + Prismatic Compass
  + Ranging Rod
  + Levelling Staff
  + Engineer's Multipurpose Tilting Level
  + Robotic Total Stations
  + Prism Pole
  + Theodolite Kit
  + Tripod
  + Steel Band Tapes (10m,20m,30m,and 50m)
  + Open Real Measuring Tapes
  + Field Notebook
  + Laptop
  + AutoCAD/ArchiCAD or other relevant software
  + Electronic Distance Machine (EDM)
  + Telescopic Leveling Rod/Staff
  + Distance Measuring Wheel
  + Hand Level
  + Dumpy Level
  + Plumb Bob
  + Surveying Marker Flags/Arrows