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**REPUBLIC OF KENYA**

**COMPETENCY-BASED CURRICULUM**

**FOR**

**CONCRETE FIELD-TESTING**

**LEVEL 4**

A close up of a logo

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TVET CDACC

P.O. BOX 15745-00100

NAIROBI

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# FOREWORD

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

Reforms in the education sector are necessary for the achievement of Kenya Vision 2030 and meeting the provisions of the Constitution of Kenya 2010. The education sector had to be aligned to the Constitution of Kenya 2010.

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

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 Survey technicians.

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**

# ACKNOWLEDGMENT

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

# KEY TO UNIT CODE

**ENG/CU/CFT/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 **CONCRETE FIELD TESTING, Level 4.** This course is designed to equip the trainee with competencies related to the application of concrete theory, testing, and skills to construction work, and the use of specific equipment, tools, and testing apparatus utilized within the construction sector. Topics include the physical characteristics and standard testing methods of materials, such as soils and aggregates, strength of materials, mixing, forming, pouring, molding, curing, and finishing as well as standard sieve, compression and proctor testing methods. Completion of this program qualifies the graduate to work in Concrete Field-Testing with all the required competencies.

**Units of Learning**

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

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

**Basic units of Competency**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit factors** |
| ENG/CU/CFT/BC/01/4/A | Communication Skills | 20 | 2 |
| ENG/CU/CFT/BC/02/4/A | Numeracy skills | 80 | 8 |
| ENG/CU/CFT/BC/03/4/A | Digital Literacy | 80 | 8 |
| ENG/CU/CFT/BC/04/4/A | Entrepreneurial Skills | 60 | 6 |
| ENG/CU/CFT/BC/05/4/A | Employability Skills | 30 | 3 |
| ENG/CU/CFT/BC/06/4/A | Environmental Literacy | 20 | 2 |
| ENG/CU/CFT/BC/07/4/A | Occupational Safety and Health Practices | 20 | 2 |
| **Total** | | **310** | **31** |

**Core Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit of Learning Code** | **Unit of Learning Title** | **Duration in Hours\*** | **Credit Factors** |
| ENG/CU/CFT/CR/01/4/A | Concrete Construction Assistant | 120 | 12 |
| ENG/CU/CFT/CR/02/4/A | Concrete Construction Field-Testing Assistant | 120 | 12 |
| ENG/CU/CFT/CR/03/4/A | Concrete Construction Field Tester | 120 | 12 |
|  | Industry/Work Attachment | 300 | 30 |
| **Total** | | **660** | **66** |
| **Grand Total** | | **970** | **97** |

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

1. Test, inspect and determine good quality materials for concrete manufacture.
2. Prepare concrete products of various classes and standards using appropriate equipment, materials.
3. Record, calculate, analyze and compute measurements and other information obtained during concrete work activities.
4. Conduct unit conversions between systems of measure (metric and imperial).
5. Interpret and edit working drawings for the construction of various formworks and determine reinforcements for concrete works.
6. Conduct processes of concrete production including mixing, casting, jointing, testing, curing, consolidating and transporting in accordance with codes and job specifications.
7. Perform finishing techniques.

**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 Concrete Field Testing, 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/CFT/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/CFT/BC/02/4/A

**RELATIONSHIP TO OCCUPATIONAL STANDARDS**

This unit addresses the unit of competency: Demonstrate numeracy skills relevant to Concrete Field-Testing (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 of 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/CFT/BC/03/4/A

**RELATIONSHIP TO OCCUPATIONAL STANDARDS**

This unit addresses the Unit of Competency: Demonstrate digital literacy relevant to Concrete Field Testing (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 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

**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/CFT/BC/04/4/A

**RELATIONSHIP TO OCCUPATIONAL STANDARDS**

This unit addresses the unit of competency: Demonstrate entrepreneurial skills relevant to Concrete Field Testing (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. 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

**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/CFT/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/CFT/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/CFT/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 LERANING

# CONCRETE CONSTRUCTION ASSISTANT

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

**RELATIONSHIP TO OCCUPATIONAL STANDARDS**:

This unit addresses Core Competencies 1, 2, 3, 4, 5, 6 and 7:

1. Test, inspect and determine good quality materials for concrete manufacture.
2. Prepare concrete products of various classes and standards using appropriate equipment, materials.
3. Record and assist calculation, analysis and computation in the measurements and other information obtained during concrete work activities
4. Conduct unit conversions between systems of measure
5. Interpret working drawings for the construction of various formworks and determining reinforcements for concrete works.
6. Conduct processes of concrete production including mixing, casting, jointing, testing, curing, consolidating and transporting in accordance with codes and job specifications.
7. Perform finishing techniques.

**DURATION OF UNIT:** 120 hours

**Unit Description**

This unit is designed to equip an individual with the competencies required for **Concrete field testing** to competently demonstrate an understanding of and skills related to the physical characteristics and standard testing methods of materials, such as soils and aggregates, and is essential to students of concrete technician disciplines. Lectures are reinforced with labs to provide a foundational level of competence in the vocabulary and vocational skills related to materials used in construction projects. Students learn about strength of materials testing, as well as standard sieve, compression and proctor testing methods. Successful completion of this unit will provide the skills and competencies required, under the supervision of a Concrete Field-Testing Technician, to undertake basic concrete construction tasks such as soil and aggregate classification, preparing concrete mixes, and pouring.

**SUMMARY OF CORE COMPETENCY LEARNING OUTCOMES FOR CONCRETE CONSTRUCTION FIELD TESTING I UNIT**

1. Work with, and to undertake, computations in both the imperial and metric systems of measure and to perform unit conversions within and between the two systems
2. Explain the origins of rock and the formation of soil deposits
3. Convey (numerically) the physical state of a soil through its index properties
4. Classify a soil according to grain size
5. Determine and express (numerically) the properties of soils
6. Describe basic concrete fundamentals and terminology

**LEARNING OUTCOMES, CONTENT AND SUGGESTED ASSESSMENT METHODS**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Work with, and to undertake, computations in both the imperial and metric systems of measure and to perform unit conversions within and between the two systems | * Express the fundamental units associated with the Imperial and Metric Systems along with the standard prefixes used to denote order of magnitude. * Perform unit conversion within and between systems of measure using first principles. * Measure volume, weight, and density of various materials, and to express them in Imperial and Metric units through formal unit conversion. | * Observation * Group Work * Tests * Assignments * Lab Exercise |
| 1. Explain the origins of rock and the formation of soil deposits. | * Identify and distinguish the characteristics of igneous, sedimentary and metamorphic rocks and to explain the weathering of rock and the formation of soil deposits. * Distinguish and explain the differences among finer, cohesive and coarser, non-cohesive soils | * Tests * Examinations |
| 1. Convey (numerically) the physical state of a soil through its index properties. | * Determine the weight/volume of air, water and solid constituents of a given soil with the aid of a phase diagram and to subsequently express (numerically) the index properties of a soil. | * Lab tests * Observations |
| 1. Classify a soil according to grain size. | * Determine the particle size distribution of a soil by sieve testing and express the results graphically in the form of a grain size distribution curve. * Express variation in particle size concisely in the form of the Uniformity Coefficient and the Coefficient of Curvature, and to compute the Fineness Modulus of an aggregate. * Classify a soil according to grain size and soil mixtures using the textural classification chart of the American Concrete Institute (ACI) | * Lab Testing |
| 1. Determine and express (numerically) the properties of soils. | * Perform the standard laboratory permeability tests on soil and express the results in the form of the Coefficient of Permeability. * Perform a standard pumping test on soil and express the results in the form of the Coefficient of Permeability and Shear. * Perform Field Compaction factor test * Determine Plasticity Index | * Lab Testing |
| 1. Describe basic concrete fundamentals and terminology | * Outline the basic materials used to produce concrete, and their approximate percentages. Outline the advantages and limitations of concrete as a building material. * State the types of Portland cement commonly used, and describe a typical application for each. * Describe the properties of finished concrete which are affected by the water to cement ratio. | * Tests * Examinations * Assignments |

**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 assignments
* Individual assignments

**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 Equipment as follows:
* Set of Sieves
* Compression testing Machine
* Molds
* Slump Test Apparatus
* Mechanical Sieve Shaker
* Drying Oven
* Concrete Mixer
* Poker Vibrator
* In-situ water permeable test kit
* Concrete cover meter
* Bulk density kit
* Coarse aggregate density test set
* Dunagan test set
* Organic impurities test set
* Los Angeles abrasion machine
* Impact testing machine
* Hand operated casagrande equipment
* Motorized casagrande equipment
* Iso 200mm test set
* Soil hydrometers
* Consolidation apparatus
* Soil volume change meter
* Concrete poker vibrator
* Gauge rods
* Chapman flask % voids in aggregates
* Coarse aggregate density test set

Soil permeable apparatus

* Plastic limit roller
* Overhead projector
* Desktop or lap top computer
* White board, markers, erasers

# CONCRETE FIELD-TESTING ASSISTANT

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

**RELATIONSHIP TO OCCUPATIONAL STANDARDS**:

This unit addresses Core Competencies 1, 2, 3, 5, 6, 7:

1. Test, inspect and determine good quality materials for concrete manufacture.

2. Prepare concrete products of various classes and standards using appropriate equipment, materials.

3. Record and assist calculation, analysis and computation in the measurements and other information obtained during concrete work activities

5. Interpret working drawings for the construction of various formworks and determining reinforcements for concrete works.

6. Conduct processes of concrete production including mixing, casting, jointing, testing, curing, consolidating and transporting in accordance with codes and job specifications.

7. Perform concrete mix and finishing techniques.

**DURATION OF UNIT:** 120 hours

**UNIT DESCRIPTION**

This unit is designed to equip an individual with the competencies required for CONCRETE FIELD TESTING to competently demonstrate an understanding of and skills related to the physical characteristics and standard testing methods of materials, such as concrete, asphalt, steel and wood and is essential to students of concrete field testing and concrete works. Students attend lectures and labs that provide a more advanced level of competence in the vocabulary and vocational skills related to materials used in construction projects. Successful completion of this unit will provide the skills and competencies required to assist a Concrete Field-Testing Technician in more advanced tasks such as concrete field testing, erection of formwork construction, analysis of aggregates, and application of weather/climate specific curing techniques.

**SUMMARY OF CORE COMPETENCY LEARNING OUTCOMES FOR CONCRETE CONSTRUCTION FIELD TESTING II UNIT**

1. Carry out basic laboratory tests and related calculations for concrete aggregates
2. Complete a concrete mix design
3. Describe basic wood fundamentals and terminology
4. Erect and strike formwork construction
5. Determine methods of concreting in adverse weather conditions

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

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| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Carry out basic laboratory tests and related calculations for concrete aggregates | * Complete a sieve analysis of the fine and coarse concrete aggregate. Plot the test results and the aggregate grading limits, and determine graphically if the aggregates meet specifications. * Calculate the dry rodded unit weight of the concrete coarse aggregate and the fineness modulus of the fine aggregate. Determine whether the dry rodded unit weight and the fineness modulus of the aggregates meet specifications for concrete production. * Calculate the % of voids present in the lab aggregate samples, and calculate the amount of cement paste required to produce concrete. * Calculate the moisture content of the concrete fine and coarse aggregates, and make appropriate adjustments to reduce the concrete mix water requirements. * Calculate the maximum allowable size of aggregate in a concrete mix to cast a structural element such as a concrete beam, based on the beam dimensions and the number and size of steel reinforcing bars. * Cast a concrete beam based on the specifications provided. Test the beam for tensile strength by loading at mid-span until failure. * Mix concrete based on the mix design provided, cast test cylinders and place in a water bath to be moist cured. Perform standard concrete tests during the casting such as slump test and concrete unit weight. * Cap the concrete test cubes when hardened. Test the cubes for compressive strength in MPa at standard curing times of 7, 14, and 28 days. * Outline the conclusions which can be drawn from the compressive strength testing data with respect to strength vs. water to cement ratio, and strength vs. time of moist curing. Use the available data from all groups, and graph the results in order to draw conclusions. Use a spreadsheet to carry out calculations and graphing. | * Lab assignments * Tests * Quizzes * Examination * Group assignments and testing |
| 1. Complete a concrete mix design | * Design a concrete mix to calculate the quantities in kg. for water, cement, coarse aggregate and fine aggregate to produce one cubic meter of concrete. * The mix design quantities are to be based on the proposed concrete use, and the material specifications which are provided. | * Tests * Lab Assignments * Quizzes |
| 1. Describe basic wood fundamentals and terminology | * Outline the advantages and limitations of wood as a building material. * Outline measures which can be taken to lessen the environmental impact of harvesting wood for use as a building material. * Outline the species of wood most often used for building materials, and the most common grades of lumber available. * Describe three ways in which the strength of wood is typically measured, and describe how the strength is affected by the grain. * Describe the advantages of engineered wood products, and compare the strength of conventional lumber to engineered wood. | * Group lab assignments * Quizzes * Observation |
| 1. Erect and strike formwork construction | * Outline procedures of erecting formwork * Determine sizes of formwork * Select sizes of formwork materials * Construction of formwork * Striking formwork | * Group discussions * Individual/group assignments |
| 1. Construct joints in concrete works | * Demonstrate the construction of joints used in concrete work * Outline the processes of forming various types of joints * Identify appropriate positions for a construction joint | * Quizzes |
| 1. Determine methods of concreting in adverse weather conditions | * Perform concreting tasks in adverse weather conditions * Apply hot weather curing techniques in concrete works | * Discussion * Tests |

**Suggested Delivery Methods**

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

**Recommended Resources**

* Occupational Health and Safety standards
* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Client/supplier instructions
* Organizational or external personnel
* Relevant professional/quality standards
* Instructional Equipment as follows:
  + Overhead projector
  + Projector Screen
  + Instructor desktop PC
  + Whiteboard(s)
* Tools and Equipment as follows:
* Compression testing Machine
* Molds
* Slump Test Apparatus
* Drying Oven
* Concrete Mixer
* Poker Vibrator
* In-situ water permeable test kit
* Concrete cover meter
* Bulk density kit
* Coarse aggregate density test set
* Dunagan test set
* Organic impurities test set
* Los Angeles abrasion machine
* Digital point load tester
* Impact testing machine
* Field CBR equipment
* CBR test machine (hand operated)
* Soil hydrometers
* Consolidation apparatus
* Soil volume change meter
* Plate bearing test machine
* Core cutter
* Concrete poker vibrator
* Gauge rods
* Chapman flask % voids in aggregates
* Coarse aggregate density test set
* Length gauge
* Automatic mechanical soil compactor
* Soil permeable apparatus
* Motorized CBR machine
* Cone penetrometer
* Plastic limit roller

# CONCRETE FIELD TESTER

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

**RELATIONSHIP TO OCCUPATIONAL STANDARDS**

This unit addresses Core Competencies 1, 2, 3, 4, 5, and 6:

1. Test, inspect and determine good quality materials for concrete manufacture
2. Prepare concrete products of various classes and standards using appropriate equipment, materials.
3. Record and assist calculation, analysis and computation in the measurements and other information obtained during concrete work activities
4. Conduct unit conversions between systems of measure
5. Interpret working drawings for the construction of various formworks and determining reinforcements for concrete works.
6. Conduct processes of concrete production including mixing, casting, jointing, testing, curing, consolidating and transporting in accordance with codes and job specifications.

**DURATION OF UNIT:** 120 hours

**UNIT DESCRIPTION**

This unit is designed to equip an individual with the competencies required for CONCRETE FIELD TESTING to competently demonstrate an understanding of and skills related to the design and production and testing of reinforced concrete. Students will be introduced to and develop skills and knowledge of how the design of reinforced concrete elements of a structure is carried out including slabs, simple and continuous beams, and the selection and placement of reinforcing steel. Successful completion of this unit will provide all of the skills and competencies required to work as a Concrete Field-Testing Technician.

**SUMMARY OF CORE COMPETENCY LEARNING OUTCOMES FOR CONCRETE CONSTRUCTION FIELD TESTING III UNIT**

1. Describe basic steel fundamentals and terminology
2. Know the individual and composite, mechanical properties of concrete and steel reinforcement.
3. Express the composite action of a reinforced concrete section subjected to direct compression.
4. Demonstrate an understanding of the behaviour, and the method of analysis, of reinforced concrete members subjected to bending.
5. Demonstrate an understanding of the behaviour of reinforced concrete columns under load and the method of analysis for evaluating ultimate capacity
6. Demonstrate an understanding of how reinforced concrete is being modified to lower its environmental impact

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Describe basic steel fundamentals and terminology | * Outline the production of iron using the blast furnace, and outline the manufacture of steel using the basic oxygen furnace and the electric arc furnace. * Outline the advantages and limitations of steel as a building material. Describe the importance of controlling the carbon content of steel. * Describe examples of modifying steel properties using alloys. * Complete stress-strain calculations and graph the stress-strain curve for a steel sample, given data on steel sample dimensions, loading and deflection. Use a spreadsheet for calculations and graphing. | * Test * Examinations * Lab Tests |
| 1. Know the individual and composite, mechanical properties of concrete and steel reinforcement. | * Evaluate the strength and stiffness of plain concrete in accordance with CSA. * Describe the types, grades and method of identification of steel reinforcement | * Group lab work * Lab tests * Lab reports |
| 1. Express the composite action of a reinforced concrete section subjected to direct compression. | * Describe the concept of relative stiffness between steel and concrete expressed in terms of the modular ratio. * Determine and work with the equivalent, transformed cross section of a composite section subjected to uniform compression. * Analyse and design a composite section subjected to ultimate compressive load. | * Written tests * Assignments |
| 1. Demonstrate an understanding of the behaviour, and the method of analysis, of reinforced concrete members subjected to bending. | * Apply flexure theory to the analysis and design of reinforced concrete beams and one-way slabs (single and double reinforced). * Demonstrate an awareness of design considerations for shear reinforcement in beams and the required spacing of stirrups | * Written Tests * Assignments |
| 1. Demonstrate an understanding of the behaviour of reinforced concrete columns under load and the method of analysis for evaluating ultimate capacity | * Elaborate on the more common types of columns in use (i.e. tied versus spiral columns) and the use of load- moment interaction diagrams in their analysis and design. | * Assignments * Written Test |
| 1. Demonstrate an understanding of how reinforced concrete is being modified to lower its environmental impact | * Identify various components of plain concrete that are used from recycled materials. * List any components of reinforced concrete that is from recycled materials. * Explain the effectiveness of various types of reinforcing materials used to strengthen concrete. | * Written tests * Examinations |

**Suggested Delivery Methods**

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

**Recommended Resources**

* Occupational Health and Safety standards
* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Client/supplier instructions
* Organizational or external personnel
* Relevant professional/quality standards
* Instructional Equipment as follows:
  + Overhead projector
  + Projector Screen
  + Instructor desktop PC
  + Whiteboard(s)
* Tools and Equipment as follows:
* Compression testing Machine
* Slump Test Apparatus
* Drying Oven
* Concrete Mixer
* Poker Vibrator
* In-situ water permeable test kit
* Concrete cover meter
* Bulk density kit
* Coarse aggregate density test set
* Organic impurities test set
* Riffle boxes (sample spliters)
* Vibrating Table
* Digital point load tester
* Impact testing machine
* Field CBR equipment
* CBR test machine (hand operated)
* Soil hydrometers
* Plate bearing test machine
* Core cutter
* Rammers
* Block making machine (manually operated)
* Concrete poker vibrator
* Gauge rods
* Chapman flask % voids in aggregates
* Coarse aggregate density test set
* Length gauge
* Automatic mechanical soil compactor
* Soil permeable apparatus
* Motorized CBR machine
* Cone penetrometer
* Plastic limit roller