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

COMPETENCY BASED CURRICULUM

FOR

ELECTRICAL INSTALLATION

LEVEL 5

TVET CDACC
P.O BOX 15745-00100
NAIROBI

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FOREWORD

The provision of quality education and training is fundamental to the Government's overall strategy for social economic development. Quality education and training will contribute to achievement Kenya's development blue print and sustainable development goals.

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

These reforms demand that Industry takes a leading role in curriculum development to ensure the curriculum addresses its competence needs. It is against this background that 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 Electrical sector's growth and sustainable development.

PRINCIPAL SECRETARY, VOCATIONAL AND TECHNICAL TRAINING

MINISTRY OF EDUCATION

PREFACE

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

The Technical and Vocational Education and Training Act No. 29 of 2013 and the Sessional Paper No. 4 of 2016 on Reforming Education and Training in Kenya, emphasized the need to reform curriculum development, assessment and certification. This called for a shift to CBET to address the mismatch between skills acquired through training and skills needed by industry as well as increase the global competitiveness of Kenyan labour force.

TVET Curriculum Development, Assessment and Certification Council (TVET CDACC), in conjunction with Electrical Engineering Sector Skills Advisory Committee (SSAC) have developed this curriculum.

This curriculum is designed and organized with an outline of learning outcomes; suggested delivery methods, training/learning resources and methods of assessing the trainee's achievement. The curriculum is competency-based and allows multiple entry and exit to the course.

I am grateful to the Council Members, Council Secretariat, Electrical Engineering 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 organizations.

I recognize with appreciation the role of the Electrical Engineering 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 Electrical 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 Electrical Sector acquire competencies that will enable them to perform their work more efficiently.

DR. LAWRENCE GUANTAI M'ITONGA, PhD

COUNCIL SECRETARY/CEO

TVET CDACC

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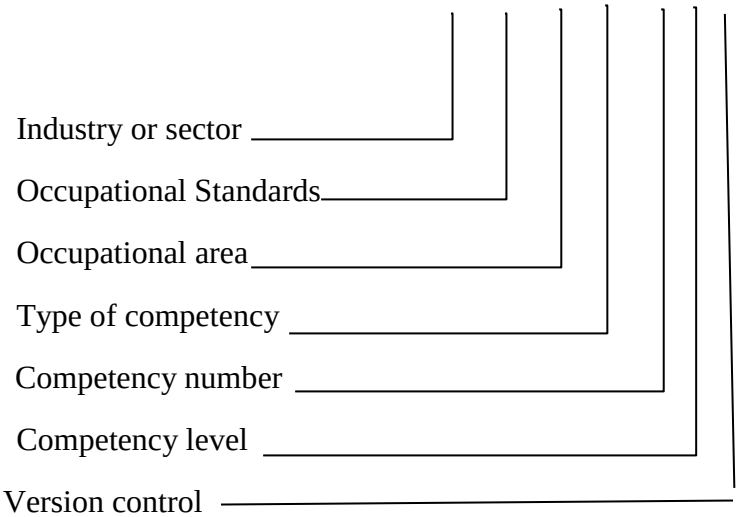
ACRONYMNS AND ABBREVIATIONS

CAD	Computer Aided Design
CCTV	Closed Circuit Tele Vision
CDACC	Curriculum Development, Assessment and Certification Council
EHS	Environment Health and Safety
IEE	Institute of Electrical Engineers
HVAC	Heating Ventilation and Air Conditioning
IBMS	Integrated Building Management System
K.C.S.E	Kenya Certificate of Secondary Education
KNQA	Kenya National Qualification Authority
KNQF	Kenya National Qualification Framework
KEBS	Kenya Bureau of Standards
KPLC	Kenya Power and Lighting Company
NCA	National Construction Authority
NEMA	National Environment Management Authority
OSHA	Occupational Safety and Health Act
PPE	Personal Protective Equipment
PV	Photo Voltaic
TVET	Technical and Vocational Education and Training
WIBA	Work Injury Benefits Act

KEY TO UNIT CODE

ENG/CU/EI/BC/01/5/A



OVERVIEW

Description of the course

This course is designed to equip electrical Craft person with the competencies required to plan, install, test, maintain and repair different types of electrical installations. The activities involved include the installation types ranging from domestic to commercial of the single-phase type.

The course consists of basic, common and core units of learning as indicated below:

Basic Units of Learning

Unit Code	Unit Title	Duration in Hours	Credit factors
ENG/CU/EI/BC/01/5	Communication skills	25	2.5
ENG/CU/EI/BC/02/5	Digital literacy	45	4.5
ENG/CU/EI/BC/03/5	Entrepreneurial skills	70	7

ENG/CU/EI/BC/04/5	Employability skills	50	5
ENG/CU/EI/BC/05/5	Environmental literacy	25	2.5
ENG/CU/EI/BC/06/5	Occupational safety and health practices	25	2.5
Total		**240**	**24**

Common Units of Learning

Unit Code	Unit Title	Duration in Hours	Credit Factors
ENG/CU/EI/CC/01/5	Engineering Mathematics	70	7
ENG/CU/EI/CC/02/5	Electrical principles	140	14
ENG/CU/EI/CC/03/5	Workshop Technology	60	6
ENG/CU/EI/CC/04/5	Technical Drawing	50	5
Total		**320**	**32**

Core Units of Learning

Unit Code	Unit Title	Duration in Hours	Credit factors
ENG/CU/EI/CR/01/5	Electrical Installation work planning	60	6
ENG/CU/EI/CR/02/5	Perform Electrical Installation	180	18
ENG/CU/EI/CR/03/5	Testing of Electrical Installation	60	6
ENG/CU/EI/CR/04/5	Electrical Installation Maintenance	90	9
ENG/CU/EI/CR/05/5	Electrical Installation Breakdown Maintenance	70	7
	Industrial Attachment	360	36
Total		**820**	**82**
GRAND TOTAL		**1,380**	**138**

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

The total duration of the **course is 1,380 hours** (46 weeks at 30 hours per week) inclusive of industrial attachment.

1. **Entry Requirements**

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

a) Kenya Certificate of Secondary Education (K.C.S.E.) with a minimum mean grade of D + (D Plus)

Or

b) Level 4 certificate in a related course with **one** year of continuous work experience

Or

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

2. **Industrial attachment**

An individual enrolled in this course will be required to undergo an industrial attachment in an Electrical firm for a period of at least 360 hours. Attachment will be undertaken upon completion of the course or the unit of learning.

3. **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 internal accredited verifier while external assessment is the responsibility of TVET/CDACC.

4. **Certification**

A candidate will be issued with a Record of Achievement on demonstration of competence in a unit of competency. To attain the qualification Electrical Technician Level 5, 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/EI/BC/01/5

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 use specialized communication skills to meet specific needs of internal and external clients, conduct interviews, facilitate discussion with groups and contribute to the development of communication strategies.

Summary of Learning Outcomes

1. Utilize specialized communication skills processes
2. Contribute to the development of communication strategies
3. Conduct interviews
4. Facilitate group discussions
5. Represent the organization

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Utilize specialized communication skills 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	❑ Observation ❑ Oral

	probing) ❑ Workplace etiquette ❑ Ethical work practices in handling communication ❑ Active listening ❑ Feedback ❑ Interpretation ❑ Flexibility in communication	
2. Contribute to the development of communication strategies	❑ Dynamics of groups ❑ Styles of group leadership ❑ Openness and flexibility in communication ❑ Communication skills relevant to client groups	❑ Written ❑ Observation
3. Conduct interviews	❑ Types of interview ❑ Establishing rapport ❑ Facilitating resolution of issues ❑ Developing action plans	❑ Written ❑ Observation
4. Facilitate group discussions	❑ Identification of communication needs ❑ Dynamics of groups ❑ Styles of group leadership ❑ Presentation of information ❑ Encouraging group members participation ❑ Evaluating group communication strategies	❑ Written ❑ Observation
5. Represent the organization	❑ Presentation techniques ❑ Development of a presentation ❑ Multi-media utilization in presentation ❑ Communication skills relevant to client groups	❑ Observation ❑ Written

Suggested Delivery Methods

- Interview
- Role playing
- Observation
- Viewing of related videos

Recommended Resources

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

BASIC COMPETENCY

DIGITAL LITERACY

UNIT CODE: ENG/CU/EI/BC/02/5

Relationship to Occupational Standards
This unit addresses the Unit of Competency: Demonstrate digital literacy

Duration of Unit: 50 hours

Unit Description
This unit describes competencies required to use a computer and other digital devices for the purposes of communication, work performance and management 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. Apply internet and email in communication at workplace
5. Apply desktop publishing in official assignments
6. Prepare presentation packages

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Identify computer hardware and software	❑ Concepts of ICT ❑ Functions of ICT ❑ History of computers ❑ Components of a computer ❑ Classification of computers	❑ Written tests ❑ Oral presentation ❑ Observation
2. 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
3. Apply computer software in solving tasks	❑ Operating system ❑ Word processing ❑ Spread sheets ❑ Data base design and manipulation	❑ Oral questioning ❑ Observation ❑ Project

	❑ Data manipulation, storage and retrieval	
4. Apply internet and email in communication at workplace	❑ Computer networks ❑ Network configurations ❑ Uses of internet ❑ Electronic mail (e-mail) concept	❑ Oral questioning ❑ Observation ❑ Oral presentation ❑ Written report
5. Apply desktop publishing in official assignments	❑ Concept of desktop publishing ❑ Opening publication window ❑ Identifying different tools and tool bars ❑ Determining page layout ❑ Opening, saving and closing files ❑ Drawing various shapes using DTP ❑ Using colour pellets to enhance a document ❑ Inserting text frames ❑ Importing and exporting text ❑ Object linking and embedding ❑ Designing of various publications ❑ Printing of various publications	❑ Oral questioning ❑ Observation ❑ Oral presentation ❑ Written report ❑ Project
6. Prepare presentation packages	❑ Types of presentation packages ❑ Procedure of creating slides ❑ Formatting slides ❑ Presentation of slides ❑ Procedure for editing objects	❑ Oral questioning ❑ Observation ❑ Oral presentation ❑ Written report ❑ Project

Suggested Delivery Methods

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

Recommended Resources

- Desk top computers
- Laptop computers
- Other digital devices
- Printers

- Storage devices
- Internet access
- Computer software

ENTREPRENEURIAL SKILLS

UNIT CODE: ENG/CU/EI/BC/03/5

Relationship to occupational standards

This unit addresses the unit of competency: Demonstrate entrepreneurial skills

Duration of unit: 80 hours

Unit description

This unit describes the competencies critical to demonstration of entrepreneurial capabilities. It involves, enhancing the entrepreneur's business skills, fostering a culture of continuous improvement at individual and organization level, implementing appropriate internal controls for profitability, improving employed capital base and undertaking regional/county business expansion.

Summary of Learning Outcomes

1. Develop one's business skill
2. Develop individual workers and teams
3. Expand markets and customers
4. Expand employed capital
5. Undertake regional/county business expansion

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Develop one's business skill	❑ Entrepreneurial skills development ❑ Market trends ❑ Monitoring and anticipating market trends ❑ New technologies in entrepreneurship ❑ Products and processes in entrepreneurship ❑ Linkages with other entrepreneurs ❑ Business conventions ad exhibitions ❑ Personal improvement and growth	❑ Observation ❑ Case studies ❑ Individual/group assignments ❑ Projects ❑ Written ❑ Oral

2. Develop individual workers and teams	❑ Good staff/workers ❑ Team building and team work ❑ Staff development and enhancement ❑ Culture of continuous improvement ❑ Increasing products and services ❑ Marketing improvement ❑ Intrapreneurship	❑ Observation ❑ Case studies ❑ Individual/group assignments ❑ projects ❑ Written ❑ Oral
3. Expand markets and customers base	❑ Maintaining appropriate cash flow in the organization ❑ Internal controls ❑ Business break-even point ❑ Business profitability determinants ❑ Prudent purchases in an enterprise ❑ Reducing business expenses ❑ Good staff/workers and customer relations ❑ Identifying and maintain new customers and markets ❑ Product/ service promotions ❑ Products / services diversification ❑ SWOT / PESTEL analysis ❑ Conducting a business survey ❑ Market expansion ❑ Small business records management ❑ Book keeping and auditing for small businesses ❑ Business support services ❑ Small business resources mobilization and utilization ❑ Basic business social responsibility ❑ Management of small business ❑ Word processing concepts in small business management ❑ Computer application software ❑ Monitoring and controlling business operations	❑ Oral ❑ Observation ❑ Case studies ❑ Individual/group assignments ❑ projects ❑ Written
4. Expand employed capital	❑ Employed capital in small businesses ❑ Share holdings ❑ Business expansion and diversification ❑ Resources for growing small business	❑ Observation ❑ Case studies ❑ Individual/group assignments

	❑ Small business Strategic Plan ❑ Cooperate Social responsibility ❑ Computer software in business development ❑ ICT and business growth	❑ projects ❑ Written
5. Undertake county/regional business expansion	❑ Region identification process ❑ Regional laws and regulation ❑ Business regional expansion requirements	❑ Oral ❑ Observation ❑ Case studies ❑ Individual/group assignments ❑ projects ❑ Written

Suggested Delivery Methods

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

Recommended Resources

- Case studies for small businesses
- Business plan templates
- Lap top/ desk top computer
- Internet
- Telephone
- Writing materials

EMPLOYABILITY SKILLS

UNIT CODE: ENG/CU/EI/BC/04/5

Relationship to Occupational Standards

This unit addresses the Unit of Competency: Demonstrate employability skills

Duration of Unit: 40 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; demonstrating critical safe work habits and leading a workplace team; 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. Lead a workplace team
4. Plan and organize work
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	❑ Self-awareness ❑ Formulating personal vision, mission and goals ❑ Strategies for overcoming life challenges ❑ Managing emotions ❑ Emotional intelligence ❑ Asserting one-self ❑ Assertiveness versus aggressiveness ❑ Expressing personal thoughts, feelings and beliefs ❑ Self esteem	❑ Observation ❑ Written ❑ Oral interview ❑ Third party report

	❑ Developing and maintaining high self-esteem ❑ Developing and maintaining positive self-image ❑ Sharing personal feelings ❑ Setting performance targets ❑ Monitoring and evaluating performance ❑ Articulating ideas and aspirations ❑ Accountability and responsibility	
2. Demonstrate critical safe work habits for employees	❑ Stress and stress management ❑ Time concept ❑ Punctuality and time consciousness ❑ Leisure ❑ Integrating personal objectives into organizational objectives ❑ Resources mobilization ❑ Resources utilization ❑ Setting work priorities ❑ Developing healthy relationships ❑ HIV and AIDS ❑ Drug and substance abuse ❑ Dealing with emerging issues	❑ Observation ❑ Written ❑ Oral interview ❑ Third party report
3. Lead a workplace team	❑ Leadership ❑ Influence ❑ Team building ❑ Determination of team roles and objectives ❑ Team parameters and relationships ❑ Individual responsibilities in a team ❑ Forms of communication ❑ Business communication ❑ Complementing team activities ❑ Gender and gender mainstreaming ❑ Human rights protocols ❑ Developing healthy relationships ❑ Maintaining relationships ❑ Conflicts and conflict resolution	❑ Observation ❑ Oral interview ❑ Written ❑ Third party report
4. Plan and organize work	❑ Planning ❑ Organizing	❑ Observation ❑ Oral interview

	❑ Schedules of activities ❑ Developing work plans ❑ Developing work goals/objectives and deliverables ❑ Monitoring work activities ❑ Evaluating work activities ❑ Resource mobilization ❑ Resource allocation ❑ Resource utilization ❑ Decision making ❑ Problem solving ❑ Negotiation	❑ Written ❑ Third party report
5. Maintain professional growth and development in the workplace	❑ Avenues for professional growth ❑ Training and career opportunities ❑ Assessing training needs ❑ Mobilizing training resources ❑ Licenses and certifications for professional growth and development ❑ Pursuing personal and organizational goals ❑ Managing work priorities and commitments ❑ Recognizing career advancement	❑ Observation ❑ Oral interview ❑ Written ❑ Third party report
6. Demonstrate learning, creativity and innovativeness in the workplace	❑ Managing own learning ❑ Mentoring ❑ Coaching ❑ Networking ❑ Variety of learning context ❑ Application of learning ❑ Safe use of technology ❑ Taking initiative/proactive ❑ Flexibility ❑ Identifying opportunities ❑ Generating new ideas ❑ 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/EI/BC/05/5

Relationship to Occupational Standards
This unit addresses the unit of competency: Demonstrate environmental literacy

Duration of Unit: 20 hours

Unit Description
This unit describes the competencies required to control environmental hazard, control environmental pollution, comply with workplace sustainable resource use, evaluate current practices in relation to resource usage, identify environmental legislations/conventions for environmental concerns, implement specific environmental programs and monitor activities on environmental protection/programs.

Summary of Learning Outcomes
1. Control environmental hazard
2. Control environmental Pollution
3. Demonstrate sustainable resource use
4. Evaluate current practices in relation to resource usage
5. Identify Environmental legislations/conventions for environmental concerns
6. Implement specific environmental programs
7. Monitor activities on Environmental protection/Programs

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

2. 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
3. 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
4. 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
5. 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
6. Implement specific environmental programs	❑ Community needs and expectations ❑ Resource availability ❑ 5 s of good housekeeping ❑ Identification of programs/Activities ❑ Setting of individual roles	❑ Written questions ❑ Oral questions ❑ Observation of work procedures ❑ Role play

	/responsibilities ❑ Resolving problems /constraints encountered ❑ Consultation with stakeholders	
7. Monitor activities on Environmental protection/Programs	❑ Periodic monitoring and Evaluation of activities ❑ Gathering feedback from stakeholders ❑ Analysing data gathered ❑ Documentation of recommendations and submission ❑ Setting of management support systems to sustain and enhance the program ❑ Monitoring and reporting of environmental incidents to concerned /proper authorities	❑ Oral questions ❑ Written tests ❑ Practical test ❑ Observation

Suggested Delivery Methods

- Instructor led facilitation of theory
- Demonstration by trainer
- Practical work by trainee
- Viewing of related videos

Recommended Resources

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

OCCUPATIONAL SAFETY AND HEALTH PRACTICES

UNIT CODE: COS/CU/HD/BC/07/5

Relationship to Occupational Standards
This unit addresses the unit of competency: Demonstrate occupational safety and health practices

Duration of Unit: 30 hours

Unit Description
This unit describes the competencies required to comply with regulatory and organizational requirements for occupational safety and health.

Summary of Learning Outcomes
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

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Identify workplace hazards and risks	❑ Identification of hazards in the workplace and/or the indicators of their presence ❑ Evaluation and/or work environment measurements of OSH hazards/risk existing in the workplace is conducted by ❑ Authorized personnel or agency ❑ Gathering of OHS issues and/or concerns raised	❑ Oral questions ❑ Written tests ❑ Observation of trainees identify hazards and risks
2. Identify and implement appropriate control measure to hazards and risks	❑ Prevention and control measures, including use of PPE (personal protective equipment) for specific hazards are identified and implemented ❑ Appropriate risk controls based on result of OSH hazard evaluation is	❑ Oral questions ❑ Written tests ❑ Practical test ❑ Observation of implementation of control measures

	recommended ❑ Contingency measures, including emergency procedures during workplace incidents and emergencies are recognized and established in accordance with organization procedures	
3. Implement OSH programs, procedures and policies/guidelines	❑ Providing information to work team about company OHS program, procedures and policies/guidelines ❑ Participating in implementation of OSH procedures and policies/ guidelines ❑ Training of team members and advice on OSH standards and procedures ❑ Implementation of procedures for maintaining OSH-related records	❑ Oral questions ❑ Written tests ❑ Practical test ❑ Observation

Suggested Delivery Methods

- Instructor led facilitation of theory
- Demonstration by trainer
- Practical work by trainee
- Viewing of related videos

Recommended Resources

- Standard operating and/or other workplace procedures manuals
- Specific job procedures manuals
- Machine/equipment manufacturer's specifications and instructions
- Personal Protective Equipment (PPE) e.g.
  - ✓ Mask
  - ✓ Face mask/shield
  - ✓ Safety boots
  - ✓ Safety harness
  - ✓ Arm/Hand guard, gloves
  - ✓ Eye protection (goggles, shield)
  - ✓ Hearing protection (ear muffs, ear plugs)
  - ✓ Hair Net/cap/bonnet
  - ✓ Hard hat
  - ✓ Face protection (mask, shield)

- ✓ Apron/Gown/coverall/jump suit
- ✓ Anti-static suits
- ✓ High-visibility reflective vest

COMMON UNITS OF LEARNING

ENGINEERING MATHEMATICS

UNIT CODE: ENG/CU/EI/CC/01/5

Relationship to Occupational Standards

This unit addresses the unit of competency: Apply engineering mathematics

Duration of Unit: 70 hours

Unit Description

This unit describes the competencies required by a technician in order to apply algebra, binomial expansion, coordinate geometry, trigonometric functions, mensuration, statistic, matrix, vectors and calculus.

Summary of Learning Outcomes

1. Apply Algebra
2. Carry out Binomial Expansion
3. Apply Coordinate Geometry
4. Apply Trigonometric functions
5. Carry out Mensuration
6. Apply Statistics
7. Apply Matrix
8. Apply Vectors
9. Apply Calculus

Learning Outcomes, Content and Suggested Assessment Methods

Building Technology Curriculum		
Learning Outcome	**Content**	**Suggested Assessment Methods**

1. Apply Algebra	❑ Base and Index ❑ Law of indices ❑ Indicial equations ❑ Laws of logarithm ❑ Logarithmic equations ❑ Conversion of bases ❑ Use of calculator ❑ Reduction of equations ❑ Solutions of simultaneous linear equations in two unknowns ❑ Solution of quadratic equation	❑ Written tests ❑ Oral questioning ❑ Assignments ❑ Supervised exercises
2. Carry out Binomial Expansion	❑ Binomial theorem Power series using binomial theorem Roots of numbers using binomial theorem. ❑ Estimation of errors of small changes using binomial theorem.	❑ Written tests ❑ Oral questioning ❑ Assignments ❑ Supervised exercises
3. Apply Coordinate Geometry	❑ Polar equations ❑ Cartesian equation ❑ Graphs of polar equations ❑ Normal and tangents	❑ Written tests ❑ Oral questioning ❑ Assignments ❑ Supervised exercises
4. Apply Trigonometry and hyperbolic functions	❑ Half -angle formula ❑ Factor formula ❑ Trigonometric functions ❑ Parametric equations ❑ Relative and absolute measures ❑ Measures calculation ❑ Osborne's Rule ❑ Ashx+bshx=C equation ❑ One-to-one relationship in functions ❑ Inverse functions for one-to-one relationship ❑ Inverse functions for trigonometric functions ❑ Graph of inverse functions of trigonometry	❑ Written tests ❑ Oral questioning ❑ Assignments ❑ Supervised exercises

5. Carry out Mensuration	❑ Units of measurements ❑ Perimeter and areas of regular figures ❑ Volume of regular solids ❑ Surface area of regular solids ❑ Area of irregular figures ❑ Areas and volumes using Pappus theorem	❑ Written tests ❑ Oral questioning ❑ Assignments ❑ Supervised exercises
6. Apply Statistics	❑ Measures of central tendency mean, mode and median ❑ Measures of dispersion ❑ Variance and standard deviation ❑ Grouped and ungrouped data presentation ❑ Application of statistics ❑ Expectation variance and S.D. ❑ Types of sampling methods	❑ Assignments ❑ Oral questioning ❑ Supervised exercises ❑ Written tests ❑ Simulation ❑ Data modelling
7. Apply Matrix methods	❑ Matrix operation ❑ Determinant of 2x2 matrix ❑ Inverse of 2x2 matrix ❑ Solution of linear simultaneous equations in 2 unknowns ❑ Application of matrices	❑ Assignments ❑ Oral questioning ❑ Supervised exercises ❑ Written tests
8. Apply Vector	❑ Vectors and scalar in two dimensions ❑ Operations on vectors: Addition and Subtraction ❑ Dot and Cross product ❑ Gradient, Divergence and curl ❑ Position vectors ❑ Resolution of vectors	❑ Assignments ❑ Oral questioning ❑ Supervised exercises ❑ Written tests
9. Apply Calculus	❑ Definition of derivatives of a function ❑ Differentiation from fist principle • Quotient rule • Product rule ❑ Definition of integration	❑ Written tests ❑ Oral questioning ❑ Assignments ❑ Supervised exercises

	❑ Definite integral ❑ Methods of integration ❑ Application of integration.	

Suggested Delivery Methods

- Group discussions
- Demonstration by trainer
- Exercises by trainee

Recommended Resources

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

WORKSHOP TECHNOLOGY

UNIT CODE: ENG/CU/EI/CC/02/5

Relationship to Occupational Standards
This unit addresses the unit of competency: Manage an Electrical workshop

Duration of Unit: 60 hours

Unit Description
This unit covers the competencies required to perform workshop process. Competencies include applying workshop Safety, use of workshop tools, instruments and equipments, preparation of workshop materials, preparation of workshop for Electrical installation practicals, Storage of Electrical tools and materials after practicals, troubleshoot and repair/replace workshop tools and equipment

Summary of Learning Outcomes

1. Apply workshop safety
2. Use of workshop tools, Instruments and equipments
3. Prepare workshop tools and instruments for an Electrical installation practical
4. Prepare the workshop for an Electrical practical
5. Store Electrical tools and materials after practicals
6. Troubleshoot and repair workshop tools and equipment

Learning Outcomes, Content and Suggested Assessment Methods:

Learning Outcome	Content	Suggested Assessment Methods
1. Apply workshop safety	❑ Meaning of PPE • Standard operating procedure in PPE ❑ Workshop rules ❑ Electrical hazards e.g. • Electric shock. ❑ Fire • Classes of fire • Causes of fire • Various methods of fire extinguishing ❑ First Aid	❑ Oral questioning ❑ Written tests ❑ Practical test

2. Use of workshop tools, Instruments and equipments	❑ Meaning of workshop tools, instruments and equipments ❑ Classification of workshop tools and equipments ❑ Uses of workshop tools, Instruments and equipments ❑ Care and Maintenance of workshop tools and Instruments	❑ Oral questioning ❑ Practical tests ❑ Written tests
3. Prepare workshop tools and instruments for an Electrical installation practical	❑ Tools and instruments for an Electrical practical • Preparation of a list of tools and instruments for an Electrical practical. • Issuing and confirmation of tools and instruments before and after practical ❑ Testing of practical tools and Instruments	❑ Observation ❑ Oral questioning ❑ Practical tests ❑ Written tests
4. Prepare workshop for an Electrical practical	❑ Practical stations ❑ Interpretation of a list of practical material	❑ Observation ❑ Oral questioning ❑ Practical tests ❑ Written tests
5. Store Electrical tools and materials after practicals	❑ Classification of workshop tools and instruments. ❑ Storage of workshop Tools and equipment ❑ Waste disposal	❑ Observation ❑ Oral questioning ❑ Practical tests ❑ Written tests
6. Troubleshoot and repair/replace workshop tools and equipment	❑ Meaning of troubleshooting ❑ Common faults in Electrical equipments Fault diagnosis procedure ❑ Repair/Replace of components in Electrical equipments	❑ Observation ❑ Oral questioning ❑ Practical tests ❑ Written tests

Suggested Methods of Delivery

- Demonstration by trainer
- Practice by the trainee
- Field trips
- On-job-training
- Discussions

Recommended Resources

Tools	**Materials and supplies**
• Set of screw drivers • Pliers • Phase testers • Multimeter	• Stationery • Cables • Lubricants • Service parts
Equipment	**Reference materials**
• PPE –hand gloves, dust coat, dust masks • Multimeter • Clamp meter • Earth electrode resistance meter • Phase sequence meter	• IEE regulations • Organizational procedures manual

ELECTRICAL PRINCIPLES

UNIT CODE: ENG/CU/EI/CC/03/5

Relationship to Occupational Standards

This unit addresses the unit of competency: Apply Electrical principles skills

Duration of Unit: 140 hours

Unit Description

This unit describes the competencies required by a technician in order to apply a wide range of Electrical principles in their work. Which includes; Use the concept of basic Electrical quantities, use of the concepts of D.C and A.C circuits in electrical installation, use of basic electrical machine, use of power factor in electrical installation, use of earthing in Electrical installations, apply Electrostatic, apply Magnetism and Electromagnetism and finally transient in Electrical circuit analysis.

Summary of Learning Outcomes

1. Use the concept of basic Electrical quantities
2. Use the concepts of D.C and A.C circuits in electrical installation
3. Use of basic electrical machine
4. Use of power factor in electrical installation
5. Use of earthing in Electrical installations
6. Apply Electrostatics
7. Apply Magnetism and Electromagnetism
8. Apply Transient in Electrical circuit analysis

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Use the concept of basic Electrical quantities	❑ The meaning of SI unit ❑ SI unit of various types of Electrical parameters ❑ Ohm's law ❑ Calculations involving various Electrical parameters e.g Power, Current, Voltage, Resistance ❑ Instruments used in measuring various types of Electrical parameters	❑ Written tests ❑ Oral questioning ❑ Assignments ❑ Supervised exercises

2. Use the concepts of D.C and A.C circuits in electrical installation	❑ Meaning of terms ❑ AC and DC, parallel and series R-L, R-C, R-L-C circuits ❑ AC and DC network theorems e.g • Kirchoff's laws • Superposition • Thevinin's • Norton's • AC to DC and DC to AC Conversion	❑ Written tests ❑ Oral questioning ❑ Assignments ❑ Supervised exercises
3. Use of basic electrical machine	❑ Types of single phase Electrical machines ❑ DC machines, ❑ AC Single phase motors and generators ❑ Transformers ❑ Application of AC and DC machines	❑ Assignments ❑ Oral questioning ❑ Supervised exercises ❑ Written tests ❑ Practical tests
4. Use of power factor in electrical installation	❑ Meaning of power factor ❑ Meaning of terms ❑ Power triangle ❑ Power factor correction	❑ Assignments ❑ Oral questioning ❑ Practical tests ❑ Observation ❑ Supervised exercises ❑ Written tests
5. Use of earthing in Electrical installations	❑ Meaning of Earthing ❑ Terms in Earthing ❑ Earthing points in Electrical installation ❑ Methods of earthing ❑ Factors to consider in selecting an earthing method ❑ Testing an earthing system	❑ Assignments ❑ Supervised exercises ❑ Written tests ❑ Practical test
6. Apply Electrostatics	❑ Meaning of Electrostatic field • Sources of Electrical static field ❑ Meaning of capacitor and capacitance ❑ Meaning of terms ❑ Types capacitors ❑ Charging and discharging ❑ Capacitors connection ❑ Calculations involving capacitors	❑ Assignments ❑ Oral questioning ❑ Supervised exercises ❑ Written tests

7. Apply Magnetism and Electromagnetism	❑ Meaning of Magnetism and magnetic fields ❑ Sources of Magnetic field ❑ Meaning of Teams ❑ Electromagnetic losses e.g Hysteresis, Leakage and flux fringing ❑ Laws of Electromagnetism ❑ Calculations in the Electromagnetism	❑
8. Apply transients in Electrical Circuit Analysis	❑ Meaning of Growth and decay in R-L & R-C circuits ❑ Calculations involving R-L& R-C circuits ❑ Application of Growth and decay in R-L & R-C Circuits	❑ Assignments ❑ Oral questioning ❑ Supervised exercises ❑ Written tests

Suggested Delivery Methods

- Group discussions
- Demonstration by trainer
- Exercises by trainee

Recommended Resources

- Scientific Calculators
- Relevant reference materials
- Stationeries
- Electrical workshop
- Relevant practical materials
- Dice
- Computers with internet connection

TECHNICAL DRAWING

UNIT CODE: ENG/CU/EI/CC/04/5

Relationship to Occupational Standards

This unit addresses the unit of competency: Prepare and interpret technical drawings

Duration of Unit: 50 hours

Unit Description

This unit covers the competencies required to prepare and interpret technical drawings. It involves competencies to select, use and maintain drawing equipment and materials. It also involves producing plain geometry drawings, solid geometry drawings, orthographic drawings of components and Electrical drawings.

Summary of Learning Outcomes

1. Use and maintain drawing equipment and materials
2. Produce plane geometry drawings
3. Produce solid geometry drawings
4. Produce pictorial and orthographic drawings of components
5. Produce Electrical drawings

Learning Outcomes, Content and Suggested Assessment Methods:

Learning Outcome	Content	Suggested Assessment Methods
1. Use and maintain drawing equipment and materials	❑ Identification and care of drawing equipment ❑ Identification and care of drawing materials ❑ Reference to manufacturer's instructions and work place procedures on use and maintenance of drawing equipment and materials ❑ Reference to relevant environmental legislations ❑ Use of Personal Protective Equipment (PPEs)	❑ Observation ❑ Oral questioning ❑ Written tests
2. Produce plane geometry drawings	❑ Types of lines in drawings ❑ Construction of geometric forms e.g.	❑ Oral questioning ❑ Practical tests

	squares, circles ❑ Construction of different angles ❑ Measurement of different angles ❑ Bisection of different angles and lines ❑ Standard drawing conventions	❑ Observation
3. Produce solid geometry drawings	❑ Interpretation of sketches and drawings of patterns e.g. cylinders, prisms and pyramids ❑ Sectioning of solids e.g. prisms, cones ❑ Development and interpenetrations of solids e.g. cylinder to cylinder and cylinder to triangular, prism	❑ Observation ❑ Practical tests ❑ Oral questioning
4. Produce orthographic drawings	❑ Meaning of pictorial and orthographic drawings ❑ Meaning of sectioning ❑ Meaning of symbols and abbreviations ❑ Drawing and interpretation of orthographic elevations ❑ Dimensioning of orthographic elevations ❑ Sectioning of views ❑ Assembly drawing	❑ Observation ❑ Practical tests ❑ Oral questioning
5. Produce electrical drawings	❑ Electrical symbols and abbreviations ❑ Meaning of electrical drawings ❑ Drawing of electrical diagrams e.g. block, schematic, circuit, line and wiring	❑ Observation ❑ Oral questioning ❑ Practical tests

Suggested Methods of Delivery

- Projects
- Demonstration by trainer
- Practice by the trainee
- Discussions

Recommended Resources

- Drawing room
- Drawing instruments e.g. T-squares, set squares, drawing sets
- Drawing tables
- Pencils, papers, erasers

- Masking tapes
- Computers installed with relevant CAD packages

CORE UNITS OF LEARNING

ELECTRICAL INSTALLATION WORK PLANNING

UNIT CODE: ENG/CU/EI/CR/01/6

Relationship to Occupational Standards
This unit addresses the unit of competency: Plan Electrical Installation Work

Duration of Unit: 60 hours

Unit Description
This unit specifies the competencies required for planning an electrical installation, ranging from surveying the site, determining system size, preparation of materials, tools, and drawings, arranging for logistics, obtaining installation drawings, preparation of work plans, establishing installation team, obtaining necessary work permit and licenses and finally preparation of work site.

Summary of Learning Outcomes

1. Conduct site survey
2. Perform system sizing
3. Prepare list of tools, equipment and materials
4. Arrange for logistics
5. Obtain installation drawings
6. Prepare installation work plan
7. Establish installation team
8. Obtain necessary permit and licences
9. Prepare work site

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Conduct site survey	❑ Type of installations • Domestic installations • Industrial installations • Commercial installations ❑ Type of building e.g. • Permanent building • Semi-permanent buildings ❑ Utilities available • Water • Electricity • Communication e.g. Phones • Installation conditions e.g. temperature, humidity, moisture ❑ Taking measurements on site • Length e.g. conduits size • Total area • Temperature • Humidity	❑ Written tests ❑ Observation ❑ Oral questioning
2. Perform system sizing	❑ Introduction to standards • IEE regulations. • Kenya bureau of standards (KEBS) • British standards • KPLC by-laws • ERC regulations • County by-laws • National Construction Authority (NCA) ❑ Reference to relevant IEE regulation tables ❑ Determining cable: ✓ Types ✓ Ratings ✓ sizes ✓ Insulation type • Protective devices	❑ Written tests ❑ Observation ❑ Oral questioning

Learning Outcome	Content	Suggested Assessment Methods
	✓ Types ✓ Ratings ❑ Reference to relevant regulations	
3. Prepare list of tools, equipment and materials	❑ Identification of tools and materials e.g. • Cutting tools • Measuring tools • Measuring equipment • Cables and conductors • Crimping tools • Conduits • Trunking • Consumables	❑ Oral questioning ❑ Written tests ❑ Observation ❑ Practicals
4. Arrange for logistics	❑ Transport for: • Materials and their safety • Personnel ❑ Storage of materials on site ❑ Site security ❑ Human resource • Skills required ❑ Communication • Purpose • Modes	❑ Written tests ❑ Oral questioning
5. Prepare installation work plan	❑ Identification of scope of installation work ❑ Preparation of work schedules • Bar charts • Gantt charts • Critical path networks	❑ Written tests ❑ Oral questioning ❑ Observation
6. Establish installation team	❑ Team building • Team members familiarization • Collaboration • Task distribution • Communication protocol	❑ Written tests ❑ Oral questioning

Learning Outcome	Content	Suggested Assessment Methods
7. Obatain the necessary permit and licences	❑ Permit to work • Meaning of terms • Types e.g. gate pass, name tag • Sources • Application procedure ❑ Classes of ERC licences • C2, C1, B, A2, A1	❑ Written tests ❑ Oral questioning
8. Prepare work site	❑ Identification of hazards and safety requirements for the site ❑ Reference to relevant regulations e.g. • Occupational Safety and Health Act (OSHA) • County by-laws ❑ Utilities • Access roads • Water • Electricity	❑ Written tests ❑ Oral questioning

Suggested Methods of Delivery

- Demonstration by trainer
- Practice by the trainee
- Field trips
- On-job-training
- Discussions

Recommended Resources

Tools	Materials and supplies
• Measuring tools • Cutting tools	• Stationery • Assorted Cables • Assorted protective devices
Equipment	**Reference materials**
• PPEs (Personal Protective Equipment) • Measuring equipment • Communication equipment	• Standards • County by-laws • Occupational Safety and Health Act (OSHA) • National Environmental

	Management Authority (NEMA) regulations • National Construction Authority (NCA) regulations • IEE tables

PERFORMING ELECTRICAL INSTALLATION

UNIT CODE: ENG/CU/EI/CR/02/5

Relationship to Occupational Standards
This unit addresses the unit of competency: Perform Electrical Installation

Duration of Unit: 180 hours

Unit Description
This unit specifies the competencies required to perform electrical installation work for single phase and three phase systems. It focuses on the application of health, safety and environmental standards, preparation of working drawings, communicating with other service providers and maintaining housekeeping during the installation process.

Summary of Learning Outcomes

1. Apply health, safety and environmental standards
2. Prepare working drawings
3. Assemble tools, equipment, materials and drawing instruments
4. Perform electrical installation
5. Facilitate other service providers
6. Maintain housekeeping

Learning Outcomes, Content and Suggested Assessment Methods:

Learning Outcome	Content	Suggested Assessment Methods
1. Apply health, safety and environmental standards	❑ Relevant clauses in appropriate Acts e.g. • Occupational safety and health act (OSHA) • Work injury benefits act (WIBA) • Environment management and coordination Act (EMCA) Relevant regulations: • IEE regulations • KPLC by-laws • County by-laws	❑ Written tests ❑ Oral questioning

	❑ Causes of accidents and sources of danger e.g burns, cuts, electric shock, falling from heights, falling objects, noise, dust, chemicals ❑ Meaning of term PPE ❑ Purpose of PPE ❑ Types of PPE ❑ Safe and correct handling, use, maintenance and storage of different types of PPE ❑ Classes of fires and fire fighting equipment ❑ First aid procedures • Rescuing electric shock victim • Methods of resuscitation	
2. Prepare working drawings	❑ Working drawings • Meaning of working drawings • Identification and care of drawing instruments and equipment • Identification of drawing paper sizes • Drawing various types of lines • Drawing title block • Drawing standard electrical symbols • Conversion of scales • Interpretation of orthographic projections • Dimensioning of drawings • Drawing of electrical diagrams ➢ Block ➢ Circuits ➢ Schematic ➢ Wiring ➢ Line	❑ Observation ❑ Oral questioning ❑ Practical tests ❑ Written tests

	• Reading and Interpretation of architectural drawings • Reading and Interpretation of electrical drawings • Use of Computer Aided Design (CAD) applications e.g. AutoCAD	
3. Assemble tools, equipment and materials	❑ Types, application, care, maintenance and storage of: • Tools e.g. ➢ Cable strippers ➢ Pliers ➢ Screw drivers ➢ Hammers ➢ Chisels ➢ Allen keys ➢ Electrician knives ➢ Crimping tools ➢ Bending springs ➢ Steel tapes ➢ Draw wires ➢ Hack saws ➢ Drills • Equipment e.g. ➢ Stock and die ➢ Vice • Materials e.g. ✓ Cables ✓ Fittings ✓ Accessories • Inventory management	❑ Observation ❑ Oral questioning ❑ Practical tests ❑ Written tests
4. Perform electrical installation	❑ Single phase systems ❑ Cables and cable joints ❑ Wiring systems and accessories • Meaning of terms • Types and applications e.g. ➢ Conduits ➢ Cable trays ➢ Cable ducts ➢ Trunkings	❑ Observation ❑ Oral questioning ❑ Practical tests ❑ Written tests

	• Preparation of wiring systems ➢ Marking out, cutting, bending, threading, chiselling, trenching ❑ Laying of cable routes ❑ Installation of final circuits • Lighting circuits ➢ One way, two way, intermediate ➢ Looping in methods at ceiling rose, joint boxes, switches • Power circuits ➢ Radial circuits, ring circuits • Water heating circuits • Electric cooker circuits • Basic call and alarm circuits • Bell circuits • Electrical machines circuits Direct online (DOL) Star-delta ❑ Relevant technical standards e.g. ➢ IEE regulations ➢ British standards ➢ Kenya bureau of standards (KEBS) ➢ Kenya power by-laws ➢ County by-laws	
5. Facilitate other service providers	❑ Communication with other service providers e.g. ➢ Plumbers ➢ Air conditioning technicians ➢ Carpenters ➢ Masons ➢ Fitters ➢ Welders	❑ Written tests ❑ Oral questioning

6. Maintain housekeeping	❑ Housekeeping ➢ Meaning of terms ➢ Safety considerations ➢ Sufficient lighting in work place ➢ Proper tools storage facility ➢ Clean workplace ➢ Proper waste disposal	❑ Written tests ❑ Oral questioning ❑ Observation

Suggested Methods of Delivery

- Projects
- Demonstration by trainer
- Practice by the trainee
- Field trips
- On-job training
- Discussions

Recommended Resources

Tools and equipment	**Materials and supplies**
➢ Cable Strippers ➢ Pliers ➢ Screw drivers ➢ Hammers ➢ Chisels ➢ Allen keys ➢ Electrician knives ➢ Crimping tools ➢ Bending springs ➢ Bending machine ➢ Steel tapes ➢ Draw wires ➢ Hack saws ➢ Drilling tools ➢ Stock and die ➢ Bench vice ➢ Machine vice ➢ PPE – hand gloves, dust coats, dust masks, helmets, ear muffs, industrial	• Stationery • Cables • Light fittings • Accessories • Conduits and fittings • Cable trays • Cable ducts • Trunkings • Computers • Drawing instruments • Screws

boots	
Reference materials • IEE regulations • Occupational safety and health act (OSHA) • Work injury benefits act (WIBA) • Manufacturers' catalogues • British standards • KEBS standards	

TESTING OF ELECTRICAL INSTALLATION

UNIT CODE: ENG/CU/EI/CR/03/5

Relationship to Occupational Standards

This unit addresses the unit of competency: Perform Testing of Electrical Installation

Duration of Unit: 60 hours

Unit Description

This unit covers the competencies required to carry out inspection and testing of an electrical installation. It covers testing activities starting from verifying the installed fittings and accessories, identifying the type of tests, carrying out the tests and issuing test certificates.

Summary of Learning Outcomes

1. Conduct physical inspection
2. Identify the test to be carried out and test equipment
3. Perform the test
4. Issue installation test and wiring certificates

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Conduct physical inspection	❑ Inspection • Reasons for inspection • Physical and visual check ➢ Firmness ➢ Loose connections ➢ Damaged accessories and fittings ➢ Colour coding	❑ Observation ❑ Oral questioning
2. Identify the test to be carried out and the test equipment	❑ Testing • Meaning • Purpose and reasons • Types of tests ➢ Polarity ➢ Effectiveness of earthing ➢ Insulation resistance ➢ Ring circuit continuity • Identification of test equipments • Specification of test equipment	❑ Observation ❑ Oral questioning ❑ Written tests

Learning Outcome	Content	Suggested Assessment Methods
	• Test equipment care, storage and maintenance	
3. Perform identified tests	❑ Reading and interpretation of appropriate manuals ❑ Identification of test equipment e.g. ➢ Continuity tester (ohmmeter) ➢ Insulation resistance tester ➢ Earth loop impedance tester ➢ Test lamp ❑ Procedure of conducting identified tests ➢ Polarity ➢ Effectiveness of earthing ➢ Insulation resistance ➢ Ring circuit continuity ❑ Recording and verification of results against appropriate standards ➢ Rectification of any anomalies ❑ Safety precautions to be observed	❑ Observation ❑ Oral questioning ❑ Practical tests ❑ Written tests
4. Issue installation test results and wiring completion certificates	❑ Installation test results certificate • Meaning terms • Importance ❑ Wiring certificate • Meaning • Importance • Types • Issuing authority	❑ Written tests ❑ Oral questioning

Suggested Methods of Delivery

- Demonstration by trainer
- Practice by the trainee
- Field trips
- Discussions

Recommended Resources

• Test instruments ➢ Continuity tester (ohmmeter) ➢ Insulation resistance tester	**Materials and supplies** • Stationery • Wiring certificates

➢ Earth loop impedance tester ➢ Test lamp	
Reference materials • Manufacturers' manuals • Relevant catalogues • IEE regulations	

ELECTRICAL INSTALLATION MAINTENANCE

UNIT CODE: ENG/CU/EI/CR/04/5

Relationship to Occupational Standards
This unit addresses the unit of competency: Maintain Electrical Installation

Duration of Unit: 90 hours

Unit Description
This unit specifies the competencies required to maintain an electrical installation, which includes preparation of maintenance schedule, inspection servicing and tests.

Summary of Learning Outcomes

1. Prepare maintenance schedule
2. Inspect electrical installation
3. Perform installation servicing
4. Conduct installation tests

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Prepare maintenance schedule	❑ Maintenance • Meaning of terms • Types and procedures ➢ Periodic service ➢ Preventive ➢ Breakdown ➢ Corrective • Scheduling maintenance based on service manuals • Safety precautions to be observed	❑ Written tests ❑ Oral questioning
2. Inspect electrical installation	❑ Identification and documentation of maintenance tools, materials and equipment ❑ Specifications of identified tools, materials and equipment against safety standards ❑ Inspection procedure ❑ Recording of inspection findings	❑ Observation ❑ Oral questioning ❑ Written tests

3. Perform installation maintenance	❑ Fill in maintenance checklist ❑ Performance of maintenance activities and updating of necessary records ❑ Disposal of waste materials e.g. • Old batteries • Oils • Lugs and screws • Tapes • Cable sheaths • Off cuts	❑ Observation ❑ Oral questioning ❑ Practical tests ❑ Written tests
4. Conduct system tests	❑ Identification of test points and parameters ❑ Safe test procedures ❑ Test results documentation	❑ Observation ❑ Oral questioning ❑ Practical tests ❑ Written tests

Suggested Methods of Delivery

- Demonstration by trainer
- Practice by the trainee
- Field trips
- On-job-training
- Discussions

Recommended Resources

Tools	**Materials and supplies**
• Set of screw drivers • Set of spanners and wrenches • Power tools • Cutting tools • Pliers • Lifting and tensioning tools • Tool box • Phase tester	• Stationery • Cables • Lubricants • Service parts
Equipment	**Reference materials**
• PPE –hand gloves, dust coat, dust masks • Multimeter • Clamp meter	• Service manuals • IEE regulations • Organization procedures manual

• Earth electrode resistance meter • Phase sequence meter	

ELECTRICAL INSTALLATION BREAKDOWN MAINTENANCE

UNIT CODE: ENG/CU/EI/CR/05/5

Relationship to Occupational Standards
This unit addresses the unit of competency: Conduct Electrical Installation Breakdown Maintenance

Duration of Unit: 70 hours

Unit Description
This unit specifies the competencies required to conduct breakdown maintenance of an electrical installation. It includes fault identification, repairing, testing and generating maintenance report.

Summary of Learning Outcomes

1. Identify system failure
2. Troubleshoot cause of failure
3. Test the repaired system
4. Test the repaired system

Learning Outcomes, Content and Suggested Assessment Methods:

Learning Outcome	Content	Suggested Assessment Methods
1. Identify installation failure	❑ Gathering information • Principle of operation • Visual inspection • Interview of users ❑ Types of failures • Partial • Total ❑ Referring to as-built drawings, Manuals	❑ Oral questioning ❑ Written tests
2. Troubleshoot cause of failure.	❑ Conducting fault diagnosis e.g. • Open circuit • Short circuit • Earth fault • Mechanical fault ❑ Identification of tools, equipment and materials for repair/replace ❑ Specification of tools	❑ Oral questioning ❑ Practical tests ❑ Written tests

	❑ Recording of installation failure results • Parameters e.g. ➢ Voltage ➢ Current ➢ Resistance	
3. Repair the installation	❑ Repair/Replace • Meaning • Isolating the installation • Conducting repair activities • Recording repair activities	❑ Observation ❑ Oral questioning ❑ Practical tests ❑ Written tests
4. Test the repaired system	❑ Identification of test and test points • Test parameters e.g. ➢ Voltage ➢ Resistance ➢ Current ❑ Testing, documenting results and maintenance report writing	❑ Observation ❑ Oral questioning ❑ Practical tests ❑ Written tests

Suggested Methods of Delivery

- Demonstration by trainer
- Practice by the trainee
- Field trips
- On-job-training
- Discussions

Recommended Resources

Tools	**Materials and supplies**
• Set of screw drivers • Pliers • Phase testers • Multimeter	• Stationery • Cables • Lubricants • Service parts
Equipment	**Reference materials**
• PPE –hand gloves, dust coat, dust masks • Multimeter • Clamp meter • Earth electrode resistance meter • Phase sequence meter	• IEE regulations • Organizational procedures manual