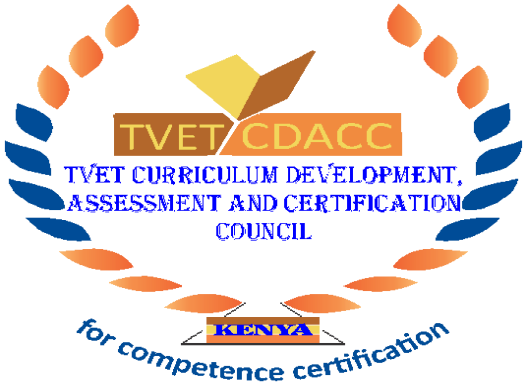
REPUBLIC OF KENYA

COMPETENCY BASED CURRICULUM

FOR

ELECTRICAL INSTALLATION

LEVEL 6



TVET CDACC
P.O BOX 15745-00100
NAIROBI

First published 2019

Council Secretary/CEO
TVET Curriculum Development, Assessment and Certification Council
P.O. Box 15745–00100 Nairobi, Kenya
Email: info@tvetcdacc.go.ke

FOREWORD

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

Reforms in the education sector are necessary for the achievement of Kenya Vision 2030 and meeting the provisions of the Constitution of Kenya 2010. The education sector had to be aligned to the Constitution and this resulted to the formulation of the Policy Framework for Reforming Education and Training. A key feature of this policy is the radical change in the design and delivery of the TVET training. This policy document requires that training in TVET be competency based, curriculum development be industry led, certification be based on demonstration of competence and mode of delivery allows for multiple entry and exit in TVET programmes.

These reforms demand that Industry takes a leading role in curriculum development to ensure the curriculum addresses its competence needs. It is against this background that this Curriculum has been developed.

It is my conviction that this curriculum will play a great role towards development of competent human resource for the 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 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 labor 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 has been developed following the CBET framework policy; the CBETA standards and guidelines provided by the TVET Authority and the Kenya National Qualification Framework designed by the Kenya National Qualification Authority.

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

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

CHAIRPERSON, TVET CDACC

ACKNOWLEDGEMENT

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

I recognize with appreciation the role of the 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 Health 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.

COUNCIL SECRETARY/CEO

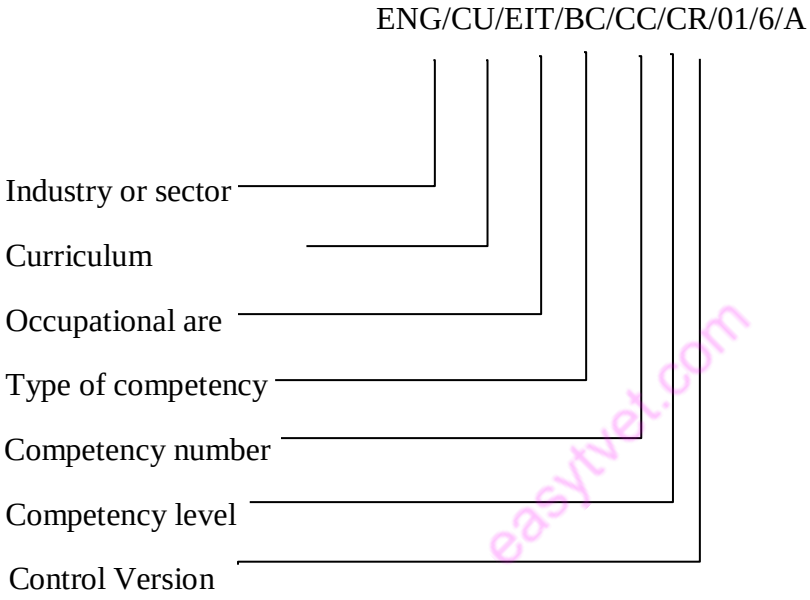
TVET CDACC

TABLE OF CONTENTS

ACRONYMNS AND ABBREVIATIONS

ENG	Engineering
IEE	Institute of Electrical engineers
IEC	International Electrotechnical Commission
KEBS	Kenya Bureau of Standards
EPRA	Energy and petroleum regulatory Authority
NCA	National Construction Authority
OSHA	Occupational Safety and Health Act
WIBA	Work injury benefits Act
IBMS	Integrated Building Management System
EHS	Environment, Health and Safety
CDACC	Curriculum Development, Assessment and Certification Council
CAD	Computer Aided Design
HAVC	Heating, Ventilation and Air Conditioning
CCTV	Closed Circuit Television
IBMS	Integrated Building Management System
PPE	Personal Protective Equipment
TVET	Technical and Vocational Education and Training
CU	Curriculum
BC	Basic Competencies
CC	Common Competencies
A	Control Version

KEY TO UNIT CODE



OVERVIEW

Description of the course

This course is designed to equip electrical technicians with the competencies required to plan, install, manage sites, test and commission, and maintain and repair different types of electrical installations. The activities involved include the installation types ranging from domestic, commercial, industrial, horticultural, agricultural electrical installations and can include generator, motor, water boiling, solar, HVAC (Heating Ventilation and Air Conditioning), IBMS (Integrated Building Management System), and security.

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/EIT/BC/01/6/A	Communication skills	60	6
ENG/CU/EIT/BC/02/6/A	Digital Literacy	40	4
ENG/CU/EIT/BC/03/6/A	Entrepreneurial skills	100	10
ENG/CU/EIT/BC/04/6/A	Employability skills	80	8
ENG/CU/EIT/BC/05/6/A	Environmental literacy	40	4
ENG/CU/EIT/BC/06/6/A	Occupational safety and health practices	40	4
Total		**360**	**36**

Common Units of Learning

Unit Code	Unit Title	Duration in Hours	Credit Factors
ENG/CU/EIT/CC/01/6/A	Engineering Mathematics	150	15
ENG/CU/EIT/CC/02/6/A	Electrical principles	150	15
ENG/CU/EIT/CC/03/6/A	Workshop Technology	150	15
ENG/CU/EIT/CC/04/6/A	Technical Drawing	150	15
Total		**600**	**60**

Core Units of Learning

Unit Code	Unit Title	Duration in Hours	Credit Factors
ENG/CU/SPV/CR/01/6/A	Electrical Installation work planning	140	140
ENG/CU/SPV/CR/02/6/A	Perform Electrical Installation	200	200
ENG/CU/SPV/CR/03/6/A	Electrical Installation Site Management	120	120

ENG/CU/SPV/CR/04/6/A	Testing of Electrical Installation	100	100
ENG/CU/SPV/CR/05/6/A	Commissioning of Electrical Installation	130	130
ENG/CU/SPV/CR/06/6/A	Electrical Installation Maintenance	140	140
ENG/CU/SPV/CR/07/6/A	Electrical Installation Breakdown Maintenance	140	140
	Industrial Attachment	480	480
Total		**1450**	**145**
Grand Total		**2410**	**241**

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

The total duration of the course is **2,410 hours** (80 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 C- (C minus)

Or

b) Level 5 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 480 hours. Attachment will be undertaken upon completion of the course or the unit of learning.

3. Trainer qualification

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

4. 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.

5. Certification

A candidate will be issued with a Certificate of competency in a unit of competency. To attain the qualification Electrical Installation technician Level 6, 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/EIT/BC/01/6/A

Relationship to Occupational Standards
This unit addresses the unit of competency: Demonstrate communication skills

Duration of Unit: 60 hours

Unit Description
This unit covers 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. Meet communication needs of clients and colleagues
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 probing) ❑ Workplace etiquette	❑ Observation ❑ Oral ❑ Written tests ❑ Practical tests

	❑ 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	❑ Observation ❑ Oral ❑ Written tests ❑ Practical tests
3. Conduct interviews	❑ Types of interview ❑ Establishing rapport ❑ Facilitating resolution of issues ❑ Developing action plans	❑ Observation ❑ Oral ❑ Written tests ❑ Practical tests
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	❑ Observation ❑ Oral ❑ Written tests ❑ Practical tests
5. Represent the organization	❑ Presentation techniques ❑ Development of a presentation ❑ Multi-media utilization in presentation ❑ Communication skills relevant to client groups	❑ Observation ❑ Oral ❑ Written tests ❑ Practical tests

Suggested Methods of Instruction

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

Recommended Resources

- Desktop computers/laptops

- Internet connection
- Projectors
- Telephone

DIGITAL LITERACY

UNIT CODE:ENG/CU/EIT/BC/02/6/A

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

Duration of Unit: 60 hours

Unit Description
This unit describes competencies required to 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 ❑ Data manipulation, storage and	❑ Oral questioning ❑ Observation ❑ Project

	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 Methods of Instruction

- 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/EIT/BC/03/6/A

Relationship to Occupational Standards
This unit addresses the unit of competency: Demonstrate communication skills

Duration of Unit: 100 hours

Unit Description
This unit covers the competencies required in meeting communication needs of clients and colleagues and developing, establishing, maintaining communication pathways and strategies. It also covers competencies for conducting interview, facilitating group discussion and representing the organization in various forums.

Summary of Learning Outcomes

1. Meet communication needs of clients and colleagues
2. Develop communication strategies
3. Establish and maintain communication pathways
4. Promote use of communication strategies
5. Conduct interview
6. Facilitate group discussion
7. Represent the organization

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Meet communication needs of clients and colleagues	❑ Communication process ❑ Modes of communication ❑ Medium of communication ❑ Effective communication ❑ Barriers to communication ❑ Flow of communication ❑ Sources of information ❑ Organizational policies	❑ Interview ❑ Written

	❑ Organization requirements for written and electronic communication methods ❑ Report writing ❑ Effective questioning techniques (clarifying and probing) ❑ Workplace etiquette ❑ Ethical work practices in handling communication ❑ Active listening ❑ Feedback ❑ Interpretation ❑ Flexibility in communication ❑ Types of communication strategies ❑ Elements of communication strategy	
2. Develop communication strategies	❑ Dynamics of groups ❑ Styles of group leadership ❑ Openness and flexibility in communication ❑ Communication skills relevant to client groups	❑ Interview ❑ Written
3. Establish and maintain communication pathways	❑ Types of communication pathways	❑ Interview ❑ Written
4. Promote use of communication strategies	❑ Application of elements of communication strategies ❑ Effective communication techniques	❑ Interview ❑ Written
5. Conduct interview	❑ Types of interview ❑ Establishing rapport ❑ Facilitating resolution of issues ❑ Developing action plans	❑ Interview ❑ Written
6. Facilitate group discussion	❑ Identification of communication needs ❑ Dynamics of groups ❑ Styles of group leadership ❑ Presentation of information ❑ Encouraging group members participation ❑ Evaluating group communication	❑ Interview ❑ Written

	strategies	
7. Represent the organization	❑ Presentation techniques ❑ Development of a presentation ❑ Multi-media utilization in presentation ❑ Communication skills relevant to client groups	❑ Interview ❑ Written

Suggested Methods of Instruction

- Discussion
- Role playing
- Simulation
- Direct instruction
- Practice by trainee

Recommended Resources

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

EMPLOYABILITY SKILLS

UNIT CODE: ENG/CU/EIT/BC/04/6/A

Relationship to Occupational Standards

This unit addresses the Unit of Competency: Demonstrate employability skills

Duration of Unit: 80 hours

Unit Description

This unit covers competencies required to demonstrate employability skills. It involves 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 ❑ Developing and maintaining high self-esteem	❑ Observation ❑ Written ❑ Oral interview ❑ Third party report

	❑ 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 ❑ Schedules of activities ❑ Developing work plans ❑ Developing work goals/objectives	❑ Observation ❑ Oral interview ❑ Written ❑ Third party report

	and deliverables ❑ Monitoring work activities ❑ Evaluating work activities ❑ Resource mobilization ❑ Resource allocation ❑ Resource utilization ❑ Decision making ❑ Problem solving ❑ Negotiation	
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 Instruction

- 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/EIT/BC/05/6/A

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

Duration of Unit: 40 hours

Unit Description
This unit describes the competencies required 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 /responsibilities	❑ Written questions ❑ Oral questions ❑ Observation of work procedures ❑ Role play

	❑ 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 Methods of Instruction

- 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: ENG/CU/EIT/BC/06/3/A

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

Duration of Unit: 40 hours

Unit Description
This unit 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 recommended ❑ Contingency measures, including emergency procedures during	❑ Oral questions ❑ Written tests ❑ Practical test ❑ Observation of implementation of control measures

	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 Methods of Instruction

- 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/EIT/CC/01/6/A

Relationship to Occupational Standards

This unit addresses the unit of competency: Apply engineering mathematics

Duration of Unit: 150 hours

Unit Description

This unit describes the competencies required by an Electrical Technician to apply a wide range of Engineering mathematics in their work. This includes applying algebraic functions, trigonometry and hyperbolic functions, complex numbers, coordinate geometry, binomial expansion, calculus, ordinary differential equations, Laplace transforms, power series, Statistics, Fourier series, vector theory, matrix, numerical methods, probability, commercial calculations, estimations and measurements in solving problems

Summary of Learning Outcomes

1. Apply Algebra
2. Apply Trigonometry and hyperbolic functions
3. Apply complex numbers
4. Apply Coordinate Geometry
5. Carry out Binomial Expansion
6. Apply Calculus
7. Solve Ordinary differential equations
8. Apply Laplace transforms
9. Apply Power Series
10. Apply Statistics
11. Apply Fourier Series
12. Apply Vector theory
13. Apply Matrix
14. Apply Numerical methods
15. Apply concept of probability for work
16. Perform commercial calculations
17. Perform Estimations, Measurements and calculations of quantities

Learning Outcomes, Content and Suggested Assessment Methods

Electrical 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 ❑ Solution of equations reduced to quadratic form ❑ Solutions of simultaneous linear equations in three unknowns ❑ Solutions of problems involving AP and GP	❑ Written tests ❑ Oral questioning ❑ Assignments ❑ Supervised exercises
2. Apply Trigonometry and hyperbolic functions	❑ Half -angle formula ❑ Factor formula ❑ Trigonometric functions ❑ Parametric equations ❑ Relative and absolute measures ❑ Measures calculation ❑ Meaning of hyperbolic equations ❑ Properties of hyperbolic functions ❑ Evaluations of hyperbolic functions Hyperbolic identities ❑ Osborne's Rule ❑ Ashx+bshx=C equation ❑ One-to-one relationship in functions ❑ Inverse functions for one-to-one relationship ❑ Inverse functions for trigonometric functions ❑ Graph of inverse functions ❑ Inverse hyperbolic functions	❑ Written tests ❑ Oral questioning ❑ Assignments ❑ Supervised exercises

3. Apply complex numbers	❑ Meaning of complex numbers ❑ Stating complex numbers in numbers in terms of conjugate argument and ❑ Modulus ❑ Representation of complex numbers on the Argand diagram ❑ Arithmetic operation of complex numbers Application of De Moivre's theorem ❑ Application of complex numbers to engineering	❑ Assignments ❑ Oral questioning ❑ Supervised exercises ❑ Written tests
4. Apply Coordinate Geometry	❑ Polar equations ❑ Cartesian equation ❑ Graphs of polar equations ❑ Normal and tangents ❑ Definition of a point ❑ Locus of a point in relation to a circle ❑ Loci of points for given mechanism	❑ Written tests ❑ Oral questioning ❑ Assignments ❑ Supervised exercises
5. 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

6. Apply Calculus	❑ Meaning of derivatives of a function ❑ Differentiation from fist principle ❑ Tables of some common derivatives ❑ Rules of differentiation ❑ Rate of change and small change ❑ Stationery points of functions of two variables ❑ Meaning of integration ❑ Indefinite and definite integral ❑ Methods of integration application of integration. ❑ Integrals of hyperbolic and inverse functions	❑ Written tests ❑ Oral questioning ❑ Assignments ❑ Supervised exercises
7. Solve Ordinary differential equations	❑ Types of first order differential equations ❑ Formation of first order differential equation ❑ Solution of first order differential equations ❑ Application of first order differential equations ❑ Formation of second order differential equations for various systems ❑ Solution of second order differential equations ❑ Application of second order differential equations	❑ Written tests ❑ Oral questioning ❑ Assignments ❑ Supervised exercises
8. Apply Laplace transforms	❑ Meaning of Laplace transforms deriving Laplace transforms from first principles ❑ State properties of Laplace transform ❑ Determination of inverse LT of simple transforms and partial fractions ❑ Solution of differential equation by LT	❑ Written tests ❑ Oral questioning ❑ Assignments ❑ Supervised exercises

	❑ Solution of simultaneous differential equation by given initial conditions	
9. Apply Power Series	❑ Meaning of the term power series ❑ Taylor's theorem ❑ Deduction of Maclaurin's theorem to obtain power series ❑ Application of Taylor's theorem and Maclaurin's theorems in numerical work	❑ Written tests ❑ Oral questioning ❑ Assignments ❑ Supervised exercises
10. Apply Statistics	❑ Classification of data Grouped data Ungrouped data ❑ Data collection ❑ Tabulation of data Class intervals Class boundaries Frequency tables ❑ Diagrammatic and graphical presentation of data e.g. Histograms Frequency polygons Bar charts Pie charts Cumulative frequency curves ❑ Measures of central tendency mean, mode and median ❑ Measures of dispersion Variance and standard deviation ❑ Definition of probability ❑ Laws of probability ❑ Expectation variance and S.D. ❑ Types of distributions ❑ Mean, variance and SD of probability distributions ❑ Application of probability distributions	❑ Assignments ❑ Oral questioning ❑ Supervised exercises ❑ Written tests ❑ Simulation ❑ Data modelling
11. Apply Fourier Series	❑ Determination of the Fourier series as a periodic function of	❑ Assignments ❑ Oral questioning

	the period 2π and extend to π ❑ Determination of Fourier series of non-periodic functions over a given range ❑ Determination of Fourier series for even and odd functions and the half-range series for a given function	❑ Supervised exercises ❑ Written tests
12. Apply Vector theory	❑ Definition of dot and cross product of vectors ❑ Solution of problems involving dot and cross production of cross ❑ Definition of operators ❑ Definition of vector field ❑ Solutions of problems involving vector fields ❑ Definition of Gradient, Divergence and curl ❑ Solutions of involving Gradient, Divergence and curl ❑ Application of vectors	❑ Assignments ❑ Oral questioning ❑ Supervised exercises ❑ Written tests
13. Apply Matrix methods	❑ Matrix operation ❑ Determinant of 3x3 matrix ❑ Inverse of 3x3 matrix ❑ Solutions of linear simultaneous equations in three unknowns ❑ Application of matrices	❑ Assignments ❑ Oral questioning ❑ Supervised exercises ❑ Written tests
14. Apply Numerical methods	❑ Meaning of interpolation and extrapolation ❑ Application of interpolation ❑ Application of interactive methods to solve equations ❑ Application of interactive methods to areas and volumes	❑ Assignments ❑ Oral questioning ❑ Supervised exercises ❑ Written tests
15. Apply concepts of probability in work	❑ Meaning of probability ❑ Types of probability events • Dependent • Independent • Mutually exclusive ❑ Laws of probability	❑ Written tests ❑ Assignments ❑ Supervised exercises

	❑ Counting techniques • Permutation • Combination • Tree diagrams • Venn diagrams	
16. Perform commercial calculations	❑ Product pricing ❑ Average sales determination ❑ Stock turnover ❑ Calculation of incomes ❑ Profit and loss calculations ❑ Salaries • Gross • Net ❑ Wages • Time rate • Flat rate • Overtime • Piece rate • Commission • Percentage • Bonus ❑ Conversion of one currency to another ❑ Exchange rates calculation • Devaluation • Revaluation	❑ Oral questioning ❑ Written tests ❑ Assignments ❑ Supervised exercises
17. Perform estimations, measurements and calculations of quantities	❑ Units of measurements and their symbols ❑ Conversion of units of measurement ❑ Calculation of length, width, height, perimeter, area and angles of figures ❑ Measuring tools and equipment ❑ Performing measurements and estimations of quantities	❑ Assignments ❑ Oral questioning ❑ Practical tests ❑ Observation ❑ Supervised exercises ❑ Written tests

Suggested Methods of Instruction

- 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/EIT/CC/02/6/A

Relationship to Occupational Standards
This unit addresses the unit of competency: Perform workshop process

Duration of Unit: 150 hours

Unit Description
This unit specifies the competencies required to manage an electrical workshop. It includes applying workshop safety, use of workshop tools, instruments and equipment, preparation of workshop tools and instruments for an electrical installation practical, storage of electrical tools and materials after practical and troubleshooting and repair/ replacement of workshop tools and equipment

Summary of Learning Outcomes

1. Apply workshop safety
2. Use of workshop tools, Instruments and equipment
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 practical
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

2. Use of workshop tools, Instruments and equipment	❑ Meaning of workshop tools, instruments and equipment ❑ Uses of workshop tools, Instruments and equipment ❑ Classification of workshop tools and equipment ❑ 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 equipment Fault diagnosis procedure ❑ Repair/Replace of components in Electrical equipment	❑ Observation ❑ Oral questioning ❑ Practical tests ❑ Written tests

Suggested Methods of Instruction

- 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/EIT/CC/03/6/A

Relationship to Occupational Standards

This unit addresses the unit of competency: Apply Electrical principles

Duration of Unit: 150 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 of 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 lightning protection measures, apply electromagnetic field theory , apply electrodynamics, apply energy and momentum in electromagnetic field, apply transient in electrical circuit analysis, use two port network, demonstrate understanding of refrigeration and air conditioning

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. Use of earthing in electrical installation
7. Apply lightning protection measures
8. Apply Electromagnetic field theory
9. Apply Electrodynamics
10. Apply Energy and momentum in Electromagnetic field
11. Apply Transient in Electrical circuit analysis
12. Use two port networks
13. Demonstrate understanding of Refrigeration and Air conditioning

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Use the concept of basic Electrical	❑ The meaning of SI unit ❑ SI unit of various types of Electrical	❑ Written tests ❑ Oral questioning

quantities	parameters ❑ Ohm's law ❑ Calculations involving various Electrical parameters e.g. Power, Current, Voltage, Resistance ❑ Instruments used in measuring various types of Electrical parameters	❑ 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 circuits ❑ AC and DC network theorems • AC to DC and DC to AC Conversion • Basic solar photovoltaic systems	❑ Written tests ❑ Oral questioning ❑ Assignments ❑ Supervised exercises
3. Use of basic electrical machine	❑ Types of Electrical machines ❑ DC machines, ❑ AC Single and three phase motors, generators and Transformers ❑ Motor starting methods e.g • DOL • Star-Delta • Auto-transformer • Resistance starter • Shaded pole • Split phase • Capacitor start • Capacitor Start and run • Face plate Starting ❑ Application of AC and DC machines ❑ Special machines and their Applications ❑ Electric Drives	❑ Assignments ❑ Oral questioning ❑ Supervised exercises ❑ Written tests ❑ Practical tests
4. Demonstrate understanding of three phase power supply	❑ Meaning of Terms ❑ Three phase power supply connection • Star connection • Delta connection ❑ Voltage, Current and power calculation ❑ Measurements of power	❑ Assignments ❑ Oral questioning ❑ Practical tests ❑ Observation ❑ Written test

	• Wattmeter methods ❑ Interconnection of three phase power supply • Star- Delta and Delta- Star	
5. 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
6. Use of earthing in Electrical installations	❑ 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
7. Apply lightening protection measures	❑ Meaning of lightening ❑ Lightening strokes and their types ❑ Lightening protection components ❑ Testing a lightening system ❑ Application of lightening system ❑ Maintenance of lightening system	❑ Assignments ❑ Oral questioning ❑ Supervised exercises ❑ Written tests
8. Apply Electromagnetic field Theory	❑ Meaning of Electromagnetic Field Theory ❑ Sources of Electromagnetic Fields ❑ Detectors of Electromagnetic radiation ❑ Application of Electromagnetic waves ❑ Electromagnetics Laws • Faraday's Law • Lenz's law • Fleming's Laws ❑ Properties and Effects of Electromagnetic waves ❑ Wave Characteristics and Shielding ❑ Skin Effect	❑ Assignments ❑ Oral questioning ❑ Supervised exercises ❑ Written tests
9. Apply Electrodynamics	❑ Meaning of Electrostatics ❑ Identification of Electrostatic terms	❑ Assignments

	and their meaning ❑ Meaning of terms in magnetostatics ❑ Electrodynamics laws Faraday's law	❑ Oral questioning ❑ Supervised exercises ❑ Written tests
10. Apply Energy and Momentum in Electromagnetic field	❑ Energy conservation theorem: • Poyntings' Theorem ❑ Momentum Energy Flow ❑ Electromagnetic Energy flow	❑ Assignments ❑ Oral questioning ❑ Supervised exercises ❑ Written tests
11. 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
12. Use Two Port networks	❑ Meaning of passive networks • Types of Passive network ❑ Characteristic impedance in T & pie networks ❑ Design of T & pie networks ❑ Transmission lines ❑ ABCD Constants ❑ Network in cascade	❑ Assignments ❑ Oral questioning ❑ Supervised exercises ❑ Written tests
13. Demonstrate understanding of Refrigeration and Air conditioning	❑ Meaning of Refrigeration and Air Conditioning ❑ Operation of Refrigeration and Air conditioning ❑ Plant layout of Refrigeration and Air conditioning system	❑ Assignments ❑ Oral questioning ❑ Supervised exercises ❑ Written tests

Suggested Methods of Instruction

- 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/EIT/CC/04/6/A

Relationship to Occupational Standards
This unit addresses the unit of competency: Prepare and interpret technical drawings

Duration of Unit: 150 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, pictorial and orthographic drawings of components and application of Computer Aided Design (CAD) packages.

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. Apply CAD packages

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. squares, circles	❑ Oral questioning ❑ Practical tests ❑ Observation

	❑ Construction of different angles ❑ Measurement of different angles ❑ Bisection of different angles and lines ❑ Standard drawing conventions	
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 pictorial drawings	❑ Meaning of pictorial drawings ❑ Drawing objects in isometric view ❑ Drawing objects in oblique view	❑ Observation ❑ Oral questioning ❑ Practical tests
6. 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
7. Apply CAD packages	❑ Identification of CAD packages e.g. AutoCAD, circuit maker ❑ Use of CAD packages in drawing of: • Plane geometry • Solid • Orthographic • Pictorial	❑ Observation ❑ Oral questioning ❑ Practical tests

	• Electrical e.g. block, schematic, circuit, line and wiring	

Suggested Methods of Instruction

- 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/EIT/CR/01/6/A

Relationship to Occupational Standards

This unit addresses the unit of competency and meets the requirements specified by the Occupational Standards: Plan Electrical Installation
Work

Duration of Unit: 140 hours

Unit Description

This unit specifies the competencies required for planning an electrical installation, ranging from surveying the site to determining the system size to preparation of materials, tools, and drawings, and establishing the team required to prepare the work site.

Summary of Learning Outcomes

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

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	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	• Written tests • Oral questioning • Observation • Practical tests
2. Perform system sizing	❑ Introduction to standards e.g ➢ 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 cables: ➢ Types ➢ Ratings ➢ sizes ➢ Insulation type ➢ Protective devices ➢ Types ➢ Ratings	❑ Written tests ❑ Observation ❑ Oral questioning ❑ Practical tests

Learning Outcome	Content	Suggested Assessment Methods
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	❑ Written tests ❑ Observation ❑ Oral questioning ❑ Practical tests
4. Plan 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 ❑ Observation ❑ Oral questioning
5. Prepare installation work plan	❑ Identification of scope of installation work ❑ Preparation of work schedules ➢ Bar charts ➢ Gantt charts ➢ Critical path networks	❑ Observation ❑ Oral questioning ❑ Written tests
6. Establish installation team	❑ Team building ❑ Team members ❑ familiarization ❑ Collaboration ❑ Task distribution ❑ Communication protocol	❑ Observation ❑ Oral questioning ❑ Written tests
7. Raise the necessary permit and licences	❑ Meaning of terms ❑ Permit to work ❑ Types e.g. gate pass, name tag ❑ Sources ❑ Application procedure ❑ Classes of ERC licences ❑ C2, C1, B, A2, A1	❑ Observation ❑ Oral questioning ❑ Written tests

Learning Outcome	Content	Suggested Assessment Methods
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 ❑	❑
9. Prepare tenders and service contracts	❑ Sources of law Law of tort Laws of contract and tendering ❑ Types and forms of contract ❑ Types of tenders ❑ Tender estimation and Sources of law ❑ Law of tort ❑ Laws of contract and ❑ tendering ❑ Types and forms of contract ❑ Types of tenders ❑ Tender estimation and costing ❑ Statutory documents in contracts and tendering	❑

Suggested Methods of Instruction

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

Recommended Resources

Tools

- Measuring tools

- Cutting tools

Equipment

- PPEs (Personal Protective Equipment)
- Measuring equipment
- Communication equipment

Materials and supplies

- Stationery
- Assorted Cables
- Assorted protective devices

Reference materials

- 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/EIT/CR/02/6/A

Relationship to Occupational Standards

This unit addresses the unit of competency and meets the requirements specified by the Occupational Standards: Perform Electrical Installation

Duration of Unit: 200 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 ❑ Causes of accidents and sources of danger e.g. burns, cuts, electric shock, falling from heights, falling objects, noise, dust, chemicals	• Written tests • Oral questioning • Observation • Practical tests

Learning Outcome	Content	Suggested Assessment Methods
	❑ 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 e.g. Electrical symbols ❑ Conversion of scales ❑ Interpretation of orthographic projections ❑ Dimensioning of drawings ❑ Drawing of electrical diagrams ❑ Block, Circuits, Schematic, Wiring and Line ❑ Reading and Interpretation of architectural drawings ❑ Reading and Interpretation of electrical drawings ❑ Use of Computer Aided Design (CAD) applications e.g. AutoCAD	❑ Written tests ❑ Observation ❑ Oral questioning ❑ Practical tests

Learning Outcome	Content	Suggested Assessment Methods
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 etc. ❑ Materials e.g. ➢ Cables ➢ Fittings ➢ Accessories ❑ Inventory management	❑ Written tests ❑ Observation ❑ Oral questioning ❑ Practical tests
4. Perform electrical installation	❑ Single phase and three phase systems ❑ Cables and cable joints ❑ Wiring systems and accessories ❑ Meaning of terms ❑ Types and applications e.g. Conduits, Cable trays, Cable ducts, Trunkings ❑ 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	❑ Written tests ❑ Observation ❑ Oral questioning

Learning Outcome	Content	Suggested Assessment Methods
	❑ Electric cooker circuits ❑ Call and alarm circuits ❑ Bell circuits ❑ Intruder alarm circuits ❑ Fire alarm circuits ❑ Electrical machines circuits e.g. Direct online (DOL), star-delta, forward and reverse ❑ Relevant technical standards e.g. ➢ IEE regulations ➢ British standards ➢ Kenya bureau of standards (KEBS)	
5. Facilitate other service providers	❑ Communication with other service providers e.g. Plumbers, Air conditioning technicians, Carpenters, Masons, Fitters, Welders etc.	❑ Observation ❑ Oral questioning ❑ Written tests
6. Maintain housekeeping	❑ Housekeeping ❑ Meaning of terms ❑ Safety considerations ❑ Sufficient lighting in work place ❑ Proper tools storage facility ❑ Clean workplace ❑ Proper waste disposal	❑ Observation ❑ Oral questioning ❑ Written tests

Suggested Methods of Instruction

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

Recommended Resources

Tools and equipment

- 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 boots

Materials and supplies

- Stationery
- Cables
- Light fittings
- Accessories
- Conduits and fittings
- Cable trays
- Cable ducts
- Trunkings
- Computers
- Drawing instruments
- Screws

Reference materials

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

ELECTRICAL INSTALLATION SITE MANAGEMENT

UNIT CODE: ENG/CU/EIT/CR/03/6/A

Relationship to Occupational Standards

This unit addresses the unit of competency and meets the requirements specified by the Occupational Standards: Manage Electrical Installation Site

Duration of Unit: 120 hours

Unit Description

This unit specifies the competencies required to manage sites where electrical installation work is undertaken. It covers the competencies in leading and monitoring activities, applying working drawings and EHS standards, preparing reports, establishing work relationship, and organizing site meetings.

Summary of Learning Outcomes

1. Assign and monitor specific site activities
2. Monitor Environment, Health and Safety (EHS) Standards
3. Oversee implementation of working drawings
4. Prepare installation reports
5. Establish work relationship
6. Organize site meetings

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Assign and monitor specific site activities	❑ Identification of site activities ❑ Interpretation of working drawings ❑ Confirmation of specifications and quality of materials ❑ Preparation of wiring systems ❑ Laying Conduits/trunks/ducts ❑ Wiring ❑ Fitting ❑ Testing and inspection ❑ Duties and responsibilities of: ➢ Supervisors ➢ Technicians ➢ Store keepers ➢ Assistants e.g. attaches,	❑ Observation ❑ Oral questioning ❑ Written tests ❑ Practical tests

Learning Outcome	Content	Suggested Assessment Methods
	➢ Interns, apprentices ➢ Security officers ❑ Preparation of site activities ➢ Monitoring checklist ➢ Timelines ➢ Daily ➢ Weekly ➢ Monthly ➢ Quarterly ➢ Yearly ❑ Parameters to be monitored ❑ Type of materials ❑ Quality and quantity of ❑ materials ❑ Tools and equipment ❑ Timelines ❑ Workforce ❑ Safety ❑ Site progress report	
2. Monitor implementation of Environment, Health and Safety (EHS) standards	❑ Meaning of terms ➢ EHS standards ❑ Relevant laws and standards: ➢ EMCA ➢ OSHA ➢ County by-laws ➢ KPLC by-laws ➢ KEBS ➢ Energy Act ❑ Safe and correct handling, use, maintenance and storage of different types of PPE ❑ Organizational safety rules and regulations	❑ Observation ❑ Oral questioning ❑ Written tests ❑ Practical tests
3. Oversee implementation of working drawings	❑ Verification of drawings against installation ❑ Editing of drawings to accommodate changes	❑ Observation ❑ Oral questioning ❑ Written tests ❑ Practical test
4. Prepare installation	❑ Generation of reports from records ❑ Records	❑ Observation ❑ Oral questioning

Learning Outcome	Content	Suggested Assessment Methods
reports and records	➢ Meaning ➢ Importance ➢ Types and formats ❑ Reports ➢ Meaning ➢ Formats as per the contract ❑ Filing	❑ Written tests ❑ Practical tests
5. Establish work relationship	❑ Organization structure ❑ Reporting relationships	❑ Observation ❑ Oral questioning ❑ Written tests ❑ Practical tests
6. Organize site meetings	❑ Procedure of holding meetings ❑ Meeting notification ➢ Agenda ➢ Quorum ➢ Minutes ❑ Report writing	❑ Observation ❑ Oral questioning ❑ Written tests ❑ Practical tests

Suggested Methods of Instruction

- Discussions
- Site visits
- On-job-training
- Charts and Audio-visual presentations
- Templates

Recommended Resources

Equipment

- Computers
- Printers
- Cameras
- Phones

Materials and supplies

- Stationery

Reference materials

- Manufacturers' catalogues
- Working drawings
- EMCA Act
- OSHA
- County by-laws

TESTING OF ELECTRICAL INSTALLATION

UNIT CODE: ENG/CU/EIT/CR/04/6/A

Relationship to Occupational Standards

This unit addresses the unit of competency and meets the requirements specified by the Occupational Standards: Perform Testing of Electrical Installation

Duration of Unit: 120 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, record test results and compile a report
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	❑ Written tests ❑ Oral questioning ❑ Practical tests ❑ Observation
2. Identify the test to be carried out and the test equipment	❑ Meaning terms ❑ Testing Purpose and reasons ❑ Types of tests Polarity Effectiveness of earthing Insulation resistance Ring circuit continuity	❑ Written tests ❑ Oral questioning ❑ Practical tests ❑ Observation

	❑ 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	❑ Written tests ❑ Oral questioning ❑ Practical tests ❑ Observation
4. Issue installation test results and wiring certificates	❑ Meaning of terms ❑ Installation test results certificate Importance ❑ Wiring certificate ➢ Meaning ➢ Importance ➢ Types ➢ Issuing authority	❑ Written tests ❑ Oral questioning ❑ Practical tests ❑ Observation

Suggested Methods of Instruction

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

Recommended Resources

- Test instruments
- Continuity tester (ohmmeter)
- Insulation resistance tester
- Earth loop impedance tester
- Test lamp

Materials and supplies

- Stationery
- Wiring certificates

Reference materials

- Manufacturers' manuals
- Relevant catalogues
- IEE regulations

COMMISSIONING OF ELECTRICAL INSTALLATION

UNIT CODE: ENG/CU/EIT/CR/05/6/A

Relationship to Occupational Standards

This unit addresses the unit of competency and meets the requirements specified by the Occupational Standards: Commissioning of Electrical Installation

Duration of Unit: 130 hours

Unit Description

This unit covers the competencies required for commissioning of electrical installation. It includes preparing commissioning schedules, notifying client, preparing as-built drawings and preparing handover procedures. It also includes conducting end-user education and preparing completion and handover documents.

Summary of Learning Outcomes

1. Prepare commissioning schedule and procedures
2. Assemble commissioning team
3. Prepare handover procedures
4. Conduct end-user education
5. Prepare as-built drawings
6. Prepare completion documents

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Prepare commissioning schedule and procedures	❑ Meaning of terms ❑ Commissioning ➢ Importance ➢ Formulation of Commissioning procedure with representatives of organization, consultant and client	❑ Observation ❑ Written tests ❑ Oral questioning ❑ Practical tests
2. Assemble commissioning team	❑ Meaning of terms ❑ Identification and briefing of the commissioning team	❑ Observation ❑ Written tests ❑ Oral questioning ❑ Practical tests
3. Prepare handover procedures	❑ Meaning of terms ➢ Handover ➢ Handover documents	❑ Observation ❑ Written tests ❑ Oral questioning ❑ Practical tests

Learning Outcome	Content	Suggested Assessment Methods
4. Prepare as- built drawings	❑ Meaning of terms ➢ As-built drawings ➢ Meaning of terms ➢ As–built drawings preparation	❑ Observation ❑ Written tests ❑ Oral questioning ❑ Practical tests
5. Conduct end- user education	❑ Meaning of terms ❑ End-user education ❑ Operation manuals and brochures ❑ Safety precautions ❑ Basic installation maintenance	❑ Observation ❑ Written tests ❑ Oral questioning ❑ Practical tests
6. Prepare completion documents	❑ Meaning of terms ❑ Completion certificate ❑ Importance ❑ Components ❑ Handover documents ❑ User manuals	❑ Observation ❑ Written tests ❑ Oral questioning ❑ Practical tests

Suggested Methods of Instruction

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

Recommended Resources

Equipment

- Drawing instruments

Materials and supplies

- Computer
- Stationery

Reference materials

- Manufacturers manuals
- IEE regulations

- KPLC by-laws
- County by-laws

ELECTRICAL INSTALLATION MAINTENANCE

UNIT CODE: ENG/CU/EIT/CR/06/6/A

Relationship to Occupational Standards

This unit addresses the unit of competency and meets the requirements specified by the Occupational Standards: Maintain Electrical Installation

Duration of Unit: 140 hours

Unit Description

This unit specifies the competencies required to maintain an electrical installation, which includes servicing and scheduled maintenance activities using safe methods.

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	❑ Meaning of terms ❑ Maintenance ➢ Types and procedures ➢ Periodic service ➢ Preventive ➢ Breakdown ➢ Corrective ❑ Scheduling maintenance based on service manuals ❑ Safety precautions to be observed	❑ Observation ❑ Written tests ❑ Oral questioning ❑ Practical tests
2. Inspect electrical installation	❑ Meaning of terms ❑ Identification and documentation of maintenance tools, materials and equipment ❑ Specifications of identified tools, materials and equipment against safety standards	❑ Observation ❑ Written tests ❑ Oral questioning ❑ Practical tests

Learning Outcome	Content	Suggested Assessment Methods
	❑ Inspection procedure ❑ Recording of inspection findings	
3. Perform installation maintenance	❑ Meaning of terms ❑ 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 ❑ Written tests ❑ Oral questioning ❑ Practical tests
4. Conduct system tests	❑ Meaning of terms ❑ Identification of test points and parameters ❑ Safe test procedures ❑ Test results documentation	❑ Observation ❑ Written tests ❑ Oral questioning ❑ Practical tests

Suggested Methods of Instruction

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

Recommended Resources

Tools

- Set of screw drivers
- Set of spanners and wrenches
- Power tools
- Cutting tools
- Pliers

- Lifting and tensioning tools
- Tool box
- Phase tester

Materials and supplies

- Stationery
- Cables
- Lubricants
- Service parts

Reference materials

- Service manuals
- IEE regulations
- Organization procedures manual

ELECTRICAL INSTALLATION BREAKDOWN MAINTENANCE

UNIT CODE: ENG/CU/EIT/CR/07/6/A

Relationship to Occupational Standards

This unit addresses the unit of competency and meets the requirements specified by the Occupational Standards: Conduct Electrical Installation Breakdown Maintenance

Duration of Unit: 140 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. Prepare list of tools, equipment & materials
4. Repair the installation
5. Test the repaired system

Learning Outcomes, Content and Suggested Assessment Methods

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

Learning Outcome	Content	Suggested Assessment Methods
	➢ Short circuit ➢ Earth fault ➢ Mechanical fault ❑ Recording of installation failure results ❑ Parameters e.g. ➢ Voltage ➢ Current ➢ Resistance	
3. Prepare list of tools, equipment & materials	❑ Safety in use of maintenance tools ❑ Maintenance tools, equipment and materials ❑ Specification of maintenance tools and equipment	❑
4. Repair the installation	❑ Meaning of terms ➢ Repair/Replace ❑ Isolating the installation ❑ Conducting repair activities ❑ Recording repair activities	❑ Observation ❑ Written tests ❑ Oral questioning ❑ Practical tests
5. Test the repaired system	❑ Meaning of terms ❑ Identification of test and test points ❑ Test parameters e.g. ➢ Voltage ➢ Resistance ➢ Current ❑ Testing, documenting results and maintenance report writing	❑ Observation ❑ Written tests ❑ Oral questioning ❑ Practical tests

Suggested Methods of Instruction

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

Recommended Resources

Tools

- Set of screw drivers

- Pliers
- Phase testers
- Multimeter

Equipment

- PPE –hand gloves, dust coat, dust masks
- Multimeter
- Clamp meter
- Earth electrode resistance meter
- Phase sequence meter

Materials and supplies

- Stationery
- Cables
- Lubricants
- Service parts

Reference materials

- IEE regulations
- Organizational procedures manual