



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

COMPETENCY BASED CURRICULUM

FOR

ELECTRICAL OPERATION (POWER OPTION)

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 engineering 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 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 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.

**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 engineering 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 Engineering Sector acquire competencies that will enable them to perform their work more efficiently.

**COUNCIL SECRETARY/CEO
TVET CDACC**

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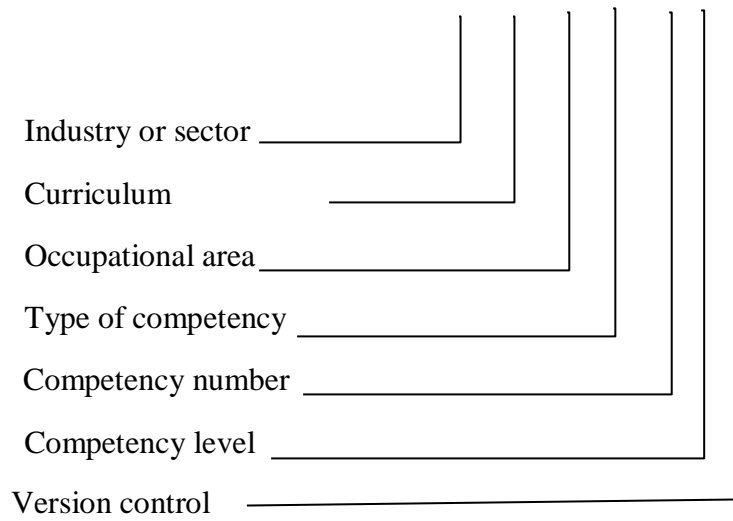
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ACRONYMNS AND ABBREVIATIONS

CAD	Computer Aided Design
CCTV	Closed Circuit Tele Vision
CDACC	Curriculum Development, Assessment and Certification Council
EHS	Environment Health and Safety
HVAC	Heating Ventilation and Air Conditioning
IBMS	Integrated Building Management System
IEE	Institute of Electrical Engineers
K.C.S.E	Kenya Certificate of Secondary Education
KEBS	Kenya Bureau of Standards
KNQA	Kenya National Qualification Authority
KNQF	Kenya National Qualification Framework
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/PO/BC/01/5/ A



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COURSE OVERVIEW

Description of the course

This course is designed to equip an Electrical operator with the competencies required to perform electrical installation, power line construction, electrical machine installation, electronics, security system installation, solar system installation and Electrical breakdown maintenance.

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/PO/BC/01/5	Communication skills	25	2.5
ENG/CU/PO/BC/02/5	Digital literacy	45	4.5
ENG/CU/PO/BC/03/5	Entrepreneurial skills	70	7
ENG/CU/PO/BC/04/5	Employability skills	50	5
ENG/CU/PO/BC/05/5	Environmental literacy	25	2.5
ENG/CU/PO/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/PO/CC/01/5	Engineering Mathematics	60	6
ENG/CU/PO/CC/02/5	Electrical principles	150	15
ENG/CU/PO/CC/03/5	Workshop Technology	60	6
ENG/CU/PO/CC/04/5	Technical Drawing	60	6
Total		330	33

Core Units of Learning

Unit Code	Unit Title	Duration in Hours	Credit Factors
ENG/CU/PO/CR/01/5	Electrical Installation	60	6
ENG/CU/PO/CR/02/5	Electrical transmission power line	90	9
ENG/CU/PO/CR/03/5	Electrical machine installation	70	7

ENG/CU/PO/CR/04/5	Electronics	60	6
ENG/CU/PO/CR/05/5	Security system installation	50	5
ENG/CU/PO/CR/06/5	Solar system installation	30	3
ENG/CU/PO/CR/07/5	Electrical Breakdown Maintenance	60	6
	Industrial Attachment	360	36
Total		780	78
Grand Total		1,350	135

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

The total duration of the **course is 1,350 hours** (45 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+ (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. Trainer qualification

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

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 Operator 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.

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BASIC UNITS OF LEARNING

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COMMUNICATION SKILLS

UNIT CODE: ENG/CU/PO/BC/01/5/A

Relationship to Occupational Standards

This unit addresses the Unit of Competency: Demonstrate Communication Skills

Duration of Unit: 25 hours

Unit Description

This unit covers the competencies required to demonstrate communication skills. It involves meeting communication needs of clients and colleagues, contributing to the development of communication strategies, conducting workplace interviews, facilitating group discussions and representing the organisation.

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. Meet communication needs of clients and colleagues	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• Interview• Third party reports• Written texts

	<ul style="list-style-type: none"> • Effective questioning techniques (clarifying and probing) • Workplace etiquette • Ethical work practices in handling communication • Active listening • Feedback • Interpretation • Flexibility in communication 	
2. Contribute to the development of communication strategies	<ul style="list-style-type: none"> • Dynamics of groups • Styles of group leadership • Openness and flexibility in communication • Communication skills relevant to client groups 	<ul style="list-style-type: none"> • Written • Observation
3. Conduct interviews	<ul style="list-style-type: none"> • Types of interview • Establishing rapport • Facilitating resolution of issues • Developing action plans 	<ul style="list-style-type: none"> • Written • Observation
4. Facilitate group discussions	<ul style="list-style-type: none"> • Identification of communication needs • Dynamics of groups • Styles of group leadership • Presentation of information • Encouraging group members participation • Evaluating group communication strategies 	<ul style="list-style-type: none"> • Written • Observation
5. Represent the organization	<ul style="list-style-type: none"> • Presentation techniques • Development of a presentation • Multi-media utilization in presentation • Communication skills relevant to client groups 	<ul style="list-style-type: none"> • Observation • Written

Suggested Methods of Instruction

- Role playing

- Viewing of related videos

Recommended Resources

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

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DIGITAL LITERACY

UNIT CODE: ENG/CU/PO/BC/02/5/A

Relationship to Occupational Standards

This unit addresses the Unit of Competency: Demonstrate Digital Literacy

Duration of Unit: 45 hours

Unit Description

This unit covers the competencies required to demonstrate digital literacy. It involves identifying appropriate computer software and hardware, applying security measures to data, hardware, software in automated environment, applying computer software in solving tasks, applying internet and email in communication at workplace, applying desktop publishing in official assignment and preparing presentation packages.

Summary of Learning Outcomes

1. Identify computer software and hardware
2. Apply security measures to data, hardware, software in automated environment
3. Apply computer software in solving tasks
4. Apply internet and email in communication at workplace
5. Apply desktop publishing in official assignments
6. Prepare presentation packages

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Identify computer hardware and software	<ul style="list-style-type: none">• Concepts of ICT• Functions of ICT• History of computers• Components of a computer• Classification of computers	<ul style="list-style-type: none">• Written tests• Oral presentation• Observation
2. Apply security measures to data, hardware and software	<ul style="list-style-type: none">• Data security and control• Security threats and control measures• Types of computer crimes• Detection and protection against computer crimes• Laws governing protection of ICT	<ul style="list-style-type: none">• Written tests• Oral presentation• Observation• Project
3. Apply computer software in solving	<ul style="list-style-type: none">• Operating system• Word processing	<ul style="list-style-type: none">• Oral questioning• Observation

tasks	<ul style="list-style-type: none"> • Spread sheets • Data base design and manipulation • Data manipulation, storage and retrieval 	<ul style="list-style-type: none"> • Project
4. Apply internet and email in communication at workplace	<ul style="list-style-type: none"> • Computer networks • Network configurations • Uses of internet • Electronic mail (e-mail) concept 	<ul style="list-style-type: none"> • Oral questioning • Observation • Oral presentation • Written report
5. Apply desktop publishing in official assignments	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Oral questioning • Observation • Oral presentation • Written report • Project
6. Prepare presentation packages	<ul style="list-style-type: none"> • Types of presentation packages • Procedure of creating slides • Formatting slides • Presentation of slides • Procedure for editing objects 	<ul style="list-style-type: none"> • Oral questioning • Observation • Oral presentation • Written report • Project

Suggested Methods of Instruction

- Demonstration
- Viewing of related videos
- Discussions
- Assignments
- Direct instructions

Recommended Resources

- Computers
- Other digital devices

- Printers
- Storage devices
- Internet access
- Computer software

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ENTREPRENEURIAL SKILLS

UNIT CODE: ENG/CU/PO/BC/03/5/A

Relationship to Occupational Standards

This unit addresses the Unit of Competency: Demonstrate Entrepreneurship

Duration of unit: 70 hours

Unit Description

This unit covers the competencies required to demonstrate understanding of entrepreneurship. It involves demonstrating understanding of an entrepreneur, entrepreneurship and self-employment. It also involves identifying entrepreneurship opportunities, creating entrepreneurial awareness, applying entrepreneurial motivation and developing business innovative strategies.

Summary of Learning Outcomes

1. Demonstrate understanding of an entrepreneur
2. Demonstrate knowledge of entrepreneurship and self-employment
3. Identify entrepreneurship opportunities
4. Create entrepreneurial awareness
5. Apply entrepreneurial motivation
6. Develop innovative business strategies
7. Develop Business plan

Learning Outcome	Content	Suggested Assessment Methods
1. Demonstrate knowledge of entrepreneurship and self-employment	<ul style="list-style-type: none">• Importance of self-employment• Requirements for entry into self-employment• Role of an Entrepreneur in business• Contributions of Entrepreneurs to National development	<ul style="list-style-type: none">• Individual/group assignments• Projects• Written tests• Oral questions• Third party report

<p>2. Identify entrepreneurship opportunities</p>	<ul style="list-style-type: none"> • Business ideas and opportunities • Sources of business ideas • Business life cycle • Legal aspects of business • Assessment of product demand • Business environment • Factors to consider when evaluating business environment • Technology in business 	<ul style="list-style-type: none"> • Individual/group assignments • Projects • Written tests • Oral questions • Third party report • Interviews
<p>3. Create entrepreneurial awareness</p>	<ul style="list-style-type: none"> • Forms of businesses • Sources of business finance • Factors in selecting source of business finance • Governing policies on Small Scale Enterprises (SSEs) • Problems of starting and operating SSEs 	<ul style="list-style-type: none"> • Individual/group assignments • Projects • Written tests • Oral questions • Third party report • Interviews
<p>4. Apply entrepreneurial motivation</p>	<ul style="list-style-type: none"> • Internal and external motivation • Motivational theories • Self-assessment • Entrepreneurial orientation • Effective communications in entrepreneurship • Principles of communication • Entrepreneurial motivation 	<ul style="list-style-type: none"> • Case studies • Individual/group assignments • Projects • Written tests • Oral questions • Third party report • Interviews
<p>5. Develop business innovative strategies</p>	<ul style="list-style-type: none"> • Innovation in business • Small business Strategic Plan • Creativity in business development • Linkages with other entrepreneurs • ICT in business growth and development 	<ul style="list-style-type: none"> • Case studies • Individual/group assignments • Projects • Written tests • Oral questions • Third party report • Interviews

6. Develop Business Plan	<ul style="list-style-type: none"> • Business description • Marketing plan • Organizational/Management plan • Production/operation plan • Financial plan • Executive summary • Presentation of Business Plan 	<ul style="list-style-type: none"> • Case studies • Individual/group assignments • Projects • Written tests • Oral questions • Third party report • Interviews
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Suggested Methods of instruction

- Direct instruction
- Project
- Case studies
- Field trips
- Discussions
- Demonstration
- Question and answer
- Problem solving
- Experiential
- Team training

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Recommended Resources

- Case studies
- Business plan templates
- Computers
- Overhead projectors
- Internet
- Mobile phone
- Video clips
- Films
- Newspapers and Handouts
- Business Journals
- Writing materials

EMPLOYABILITY SKILLS

UNIT CODE: ENG/CU/PO/BC/04/5/A

Relationship to Occupational Standards

This unit addresses the Unit of Competency: Demonstrate Employability Skills

Duration of Unit: 50 hours

Unit Description

This unit covers competencies required to demonstrate employability skills. It involves conducting self-management, demonstrating interpersonal communication, critical safe work habits, leading a workplace team, planning and organizing work, maintaining professional growth and development, demonstrating workplace learning, problem solving skills and managing workplace ethics.

Summary of Learning Outcomes

1. Conduct self-management
2. Demonstrate interpersonal communication
3. Demonstrate critical safe work habits
4. Lead small teams
5. Plan and organize work
6. Maintain professional growth and development
7. Demonstrate workplace learning
8. Demonstrate problem solving skills
9. Demonstrate workplace ethics

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Conduct self-management	<ul style="list-style-type: none">• Self-awareness• Formulating personal vision, mission and goals• Strategies for overcoming life challenges• Emotional intelligence• Assertiveness versus aggressiveness• Expressing personal thoughts, feelings and beliefs	<ul style="list-style-type: none">• Written tests• Oral questioning• Interviewing• Portfolio of evidence• Third party report

	<ul style="list-style-type: none"> • Developing and maintaining high self-esteem • Developing and maintaining positive self-image • Articulating ideas and aspirations • Accountability and responsibility • Good work habits • Self-awareness • Self-development • Financial literacy • Healthy lifestyle practices 	
2. Demonstrate interpersonal communication	<ul style="list-style-type: none"> • Meaning of interpersonal communication • Listening skills • Types of audience • Writing skills • Reading skills • Meaning of empathy • Understanding customers' needs • Establishing communication networks • Sharing information 	<ul style="list-style-type: none"> • Written tests • Oral questioning • Interviewing • Portfolio of evidence • Third party report
3. Demonstrate critical safe work habits	<ul style="list-style-type: none"> • Stress and stress management • Punctuality and time consciousness • Leisure • Integrating personal objectives into organizational objectives • Resources utilization • Setting work priorities • HIV and AIDS • Drug and substance abuse • Handling emerging issues 	<ul style="list-style-type: none"> • Written tests • Oral questioning • Interviewing • Portfolio of evidence • Third party report
4. Lead a small team	<ul style="list-style-type: none"> • Leadership qualities • Team building • Determination of team roles and objectives • Team performance indicators • Responsibilities in a team 	<ul style="list-style-type: none"> • Written tests • Oral questioning • Interviewing • Portfolio of evidence • Third party report

	<ul style="list-style-type: none"> • Forms of communication • Complementing team activities • Gender and gender mainstreaming • Human rights • Maintaining relationships • Conflicts and conflict resolution 	
5. Plan and organize work	<ul style="list-style-type: none"> • Functions of management <ul style="list-style-type: none"> • Planning • Organizing • Time management • Decision making process • Task allocation • Evaluating work activities • Resource utilization • Problem solving • Collecting and organising information 	<ul style="list-style-type: none"> • Written tests • Oral questioning • Interviewing • Portfolio of evidence • Third party report
6. Maintain professional growth and development	<ul style="list-style-type: none"> • Opportunities for professional growth • Assessing training needs • Licenses and certifications for professional growth and development • Pursuing personal and organizational goals • Identifying work priorities • Recognizing career advancement 	<ul style="list-style-type: none"> • Written tests • Oral questioning • Interviewing • Portfolio of evidence • Third party report
7. Demonstrate workplace learning	<ul style="list-style-type: none"> • Managing own learning • Contributing to the learning community at the workplace • Cultural aspects of work • Variety of learning context • Application of learning • Safe use of technology • Identifying opportunities • Generating new ideas • Workplace innovation • Performance improvement 	<ul style="list-style-type: none"> • Written tests • Oral questioning • Interviewing • Portfolio of evidence • Third party report

	<ul style="list-style-type: none"> • Handling emerging issues • Future trends and concerns in learning 	
8. Demonstrate problem solving skills	<ul style="list-style-type: none"> • Problem identification • Problem solving • Application of problem-solving strategies • Resolving customer concerns 	<ul style="list-style-type: none"> • Written tests • Oral questioning • Interviewing • Portfolio of evidence • Third party report
9. Demonstrate workplace ethics	<ul style="list-style-type: none"> • Meaning of ethics • Ethical perspectives • Principles of ethics • Values and beliefs • Ethical standards • Organization code of ethics • Common ethical dilemmas • Organization culture • Corruption, bribery and conflict of interest • Privacy and data protection • Diversity, harassment and mutual respect • Financial responsibility/accountability • Etiquette • Personal and professional integrity • Commitment to jurisdictional laws • Emerging issues in ethics 	<ul style="list-style-type: none"> • Written tests • Oral questioning • Interviewing • Portfolio of evidence • Third party report

Suggested Methods of Instruction

- Demonstrations
- Simulation/Role play
- Discussion
- Presentations
- Case studies
- Q&A

Recommended Resources

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

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ENVIRONMENTAL LITERACY

UNIT CODE: ENG/CU/PO/BC/05/5/A

Relationship to Occupational Standards

This unit addresses the Unit of Competency: Demonstrate Environmental Literacy

Duration of Unit: 25 hours

Unit Description

This unit describes the competencies required to demonstrate understanding of environmental literacy. It involves controlling environmental hazard, controlling control environmental pollution, complying with workplace sustainable resource use, evaluating current practices in relation to resource usage, identifying environmental legislations/conventions for environmental concerns, implementing specific environmental programs and monitoring activities on environmental protection/programs.

Summary of Learning Outcomes

1. Control environmental hazards
2. Control environmental Pollution
3. Demonstrate sustainable use of resource
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 hazards	<ul style="list-style-type: none">• 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)	<ul style="list-style-type: none">• Written test• Oral questions• Observation

<p>2. Control environmental Pollution control</p>	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Written test • Oral questions • Observation
<p>3. Demonstrate sustainable resource use</p>	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Written test • Oral questions • Observation
<p>4. Evaluate current practices in relation to resource usage</p>	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Written test • Oral questions • Observation
<p>5. Identify Environmental legislations/conventions for environmental concerns</p>	<ul style="list-style-type: none"> • Environmental issues/concerns • Environmental legislations /conventions and local ordinances • Industrial standard /environmental practices • International Environmental Protocols (Montreal, Kyoto) • Features of an environmental strategy 	<ul style="list-style-type: none"> • Written questions • Oral questions • Observation
<p>6. Implement specific environmental programs</p>	<ul style="list-style-type: none"> • Community needs and expectations • Resource availability • 5 s of good housekeeping • Identification of programs/Activities 	<ul style="list-style-type: none"> • Written questions • Oral questions • Observation

	<ul style="list-style-type: none"> • Setting of individual roles /responsibilities • Resolving problems /constraints encountered • Consultation with stakeholders 	
7. Monitor activities on Environmental protection/Programs	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Oral questions • Written tests • Practical test • Observation

Suggested Methods of Instruction

- Instructor led facilitation of theory
- Demonstration by trainer
- Viewing of related videos
- Project
- Assignments
- Role play

Recommended Resources

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

OCCUPATIONAL SAFETY AND HEALTH PRACTICES

UNIT CODE:ENG/CU/PO/BC/06/5/A

Relationship to Occupational Standards

This unit addresses the unit of competency: Demonstrate occupational safety and health practices

Duration of Unit: 25 hours

Unit Description

This unit specifies the competencies required to identify workplace hazards and risk, identify and implement appropriate control measures and implement OSH programs, procedures and policies/guidelines

Summary of Learning Outcomes

1. Identify workplace hazards and risk
2. Control OSH hazards
3. Implement OSH programs

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Identify workplace hazards and risks	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• Oral questions• Written tests• Portfolio of evidence• Third party report
2. Control OSH hazards	<ul style="list-style-type: none">• Prevention and control measures, including use of PPE (personal protective equipment) for specific hazards are identified and implemented• Appropriate risk controls based on	<ul style="list-style-type: none">• Oral questions• Written tests• Portfolio of evidence• Third party report

		<p>result of OSH hazard evaluation is recommended</p> <ul style="list-style-type: none"> Contingency measures, including emergency procedures during workplace incidents and emergencies are recognized and established in accordance with organization procedures 	
3. Implement programs	OSH	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> Oral questions Written tests Portfolio of evidence Third party report

Suggested Methods of Instruction

- Assignments
- Discussion
- Q&A
- Role play
- Viewing of related videos

Recommended Resources

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

- ✓ Hard hat
- ✓ Face protection (mask, shield)
- ✓ Apron/Gown/coverall/jump suit
- ✓ Anti-static suits
- ✓ High-visibility reflective vest

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COMMON UNITS OF LEARNING

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ENGINEERING MATHEMATICS

UNIT CODE: ENG/CU/PO/CC/01/5/A

Relationship to Occupational Standards

This unit addresses the unit of competency: Apply Engineering mathematics

Duration of Unit: 60 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, application of trigonometry and hyperbolic functions, applying complex numbers, coordinate geometry, carrying out binomial expansion, calculus, statistics, vector theory, matrix and numerical methods in solving problems, probability, commercial calculations, performing estimations, measurements and calculation of quantities.

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. Apply Statistics
8. Apply Vector theory
9. Apply Matrix
10. Apply Numerical methods
11. Apply concept of probability for work
12. Perform commercial calculations
13. Perform Estimations, Measurements and calculations of quantities

Learning Outcomes, Content and Suggested Assessment Methods

Electrical Curriculum		
Learning Outcome	Content	Suggested Assessment Methods

<p>1. Apply Algebra</p>	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Written tests • Oral questioning • Assignments • Supervised exercises
<p>2. Apply Trigonometry and hyperbolic functions</p>	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Written tests • Oral questioning • Assignments • Supervised exercises

<p>3. Apply complex numbers</p>	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Assignments • Oral questioning • Supervised exercises • Written tests
<p>4. Apply Coordinate Geometry</p>	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Written tests • Oral questioning • Assignments • Supervised exercises
<p>5. Carry out Binomial Expansion</p>	<ul style="list-style-type: none"> • Binomial theorem Power series using binomial theorem Roots of numbers using binomial theorem. • Estimation of errors of small changes using binomial theorem. 	<ul style="list-style-type: none"> • Written tests • Oral questioning • Assignments • Supervised exercises

6. Apply Calculus	<ul style="list-style-type: none"> • Meaning of derivatives of a function • Differentiation from first 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 	<ul style="list-style-type: none"> • Written tests • Oral questioning • Assignments • Supervised exercises
7. Apply Statistics	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Assignments • Oral questioning • Supervised exercises • Written tests • Simulation • Data modelling

	<ul style="list-style-type: none"> • Laws of probability • Expectation variance and S.D. • Types of distributions • Mean, variance and SD of probability distributions • Application of probability distributions 	
8. Apply Vector theory	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Assignments • Oral questioning • Supervised exercises • Written tests
9. Apply Matrix methods	<ul style="list-style-type: none"> • Matrix operation • Determinant of 3x3 matrix • Inverse of 3x3 matrix • Solutions of linear simultaneous equations in 3 unknowns • Application of matrices 	<ul style="list-style-type: none"> • Assignments • Oral questioning • Supervised exercises • Written tests
10. Apply Numerical methods	<ul style="list-style-type: none"> • Meaning of interpolation and extrapolation • Application of interpolation • Application of interactive methods to solve equations • Application of interactive methods to areas and volumes 	<ul style="list-style-type: none"> • Assignments • Oral questioning • Supervised exercises • Written tests
11. Apply concepts of	<ul style="list-style-type: none"> • Meaning of probability 	<ul style="list-style-type: none"> • Written tests

probability in work	<ul style="list-style-type: none"> • Types of probability events • Dependent • Independent • Mutually exclusive • Laws of probability • Counting techniques • Permutation • Combination • Tree diagrams • Venn diagrams 	<ul style="list-style-type: none"> • Assignments • Supervised exercises
12. Perform commercial calculations	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Oral questioning • Written tests • Assignments • Supervised exercises
13. Perform estimations, measurements and calculations of quantities	<ul style="list-style-type: none"> • Units of measurements and their symbols • Conversion of units of measurement • Calculation of length, width, height, perimeter, area and angles of figures 	<ul style="list-style-type: none"> • Assignments • Oral questioning • Practical tests • Observation • Supervised exercises • Written tests

	<ul style="list-style-type: none">• Measuring tools and equipment• Performing measurements and estimations of quantities	
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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

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WORKSHOP TECHNOLOGY

UNIT CODE: ENG/CU/PO/CC/02/6/A

Relationship to Occupational Standards

This unit addresses the unit of competency: Perform workshop process.

Duration of Unit: 60 hours

Unit Description

This unit covers the competencies required to perform workshop processes. 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 and troubleshoot and repair 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 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	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• Oral questioning• Written tests
2. Use of workshop tools, Instruments	<ul style="list-style-type: none">• Meaning of workshop tools, instruments and equipments	<ul style="list-style-type: none">• Oral questioning• Practical tests

and equipments	<ul style="list-style-type: none"> • Uses of workshop tools, Instruments and equipments • Classification of workshop tools and equipments • Care and Maintenance of workshop tools and Instruments 	<ul style="list-style-type: none"> • Written tests
3. Prepare workshop tools and instruments for an Electrical installation practical	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Observation • Oral questioning • Practical tests • Written tests
4. Prepare workshop for an Electrical practical	<ul style="list-style-type: none"> • Practical stations • Interpretation of a list of practical material 	<ul style="list-style-type: none"> • Observation • Oral questioning • Practical tests • Written tests
5. Store Electrical tools and materials after practicals	<ul style="list-style-type: none"> • Classification of workshop tools and instruments. • Storage of workshop Tools and equipment • Waste disposal 	<ul style="list-style-type: none"> • Observation • Oral questioning • Practical tests • Written tests
6. Troubleshoot and repair/replace workshop tools and equipment	<ul style="list-style-type: none"> • Meaning of troubleshooting • Common faults in Electrical equipments • Fault diagnosis procedure • Repair/Replace of components in Electrical equipments 	<ul style="list-style-type: none"> • Observation • Oral questioning • Practical tests • Written tests

Suggested methods of instructions

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

Recommended Resources

- Set of screw drivers
- Pliers
- Phase testers
- Multimeter
- Stationery
- Cables
- Lubricants
- Service parts
- PPE –hand gloves, dust coat, dust masks
- Multimeter
- Clamp meter
- Earth electrode resistance meter
- Phase sequence meter

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ELECTRICAL PRINCIPLES

UNIT CODE: ENG/CU/PO/CC/03/5/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, demonstrating the understanding of three phase power supply systems, use of power factor in electrical installation, use of earthing in Electrical installations, apply lightning protection measures and apply Electromagnetic field theory

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. Demonstrate understanding of three phase power supply
5. Use of power factor in electrical installation
6. Use of earthing in Electrical installations
7. Apply lightning protection measures
8. Apply Electromagnetic field theory

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Use the concept of basic Electrical quantities	<ul style="list-style-type: none">• The meaning of SI unit• Basic SI units• Length• Mass• Time• SI unit of various types of Electrical parameters e.g.• Coulomb• Joule• Ohm	<ul style="list-style-type: none">• Written tests• Oral questioning• Assignments• Supervised exercises

	<ul style="list-style-type: none"> • Watt • Siemen • Newton • Volt • Ohm's law • Calculations involving various Electrical parameters e.g. Power, Current, Voltage, Resistance • Instruments used in measuring various types of Electrical parameters 	
2. Use the concepts of D.C and A.C circuits	<ul style="list-style-type: none"> • Meaning of terms • AC and DC, parallel and series circuits, R-L-C circuits • Network theorems • Thevenin's theorem • Superposition • Kirchhoff's laws i.e. current and voltage laws • Norton theorem • AC to DC and DC to AC Conversion • Basic solar photovoltaic systems • T₁ • T₂ 	<ul style="list-style-type: none"> • Written tests • Oral questioning • Assignments • Supervised exercises
3. Use of basic electrical machine	<ul style="list-style-type: none"> • Types of Electrical machines • Basic construction, operation, and maintenance of electrical machines • Motors (AC and DC) • Generators (AC and DC) • Motor winding • AC Single and three phase motors, generators and Transformers • Motor Starting methods <ul style="list-style-type: none"> • DOL • Star-Delta 	<ul style="list-style-type: none"> • Assignments • Oral questioning • Supervised exercises • Written tests • Practical tests

	<ul style="list-style-type: none"> • Shaded pole • Split phase • Capacitor start • Application of AC and DC machines 	
4. Demonstrate understanding of three phase power supply	<ul style="list-style-type: none"> • Meaning of Terms • Three phase power supply connection • Star connection • Delta connection • Voltage, Current and power calculation • Measurements of power • Wattmeter methods • Interconnection of three phase power supply • Star- Delta and Delta- Star 	<ul style="list-style-type: none"> • Assignments • Oral questioning • Supervised exercises • Written tests • Practical tests
5. Use of power factor in electrical installation	<ul style="list-style-type: none"> • Meaning of power factor • Meaning of terms • Power triangle • Power factor correction 	<ul style="list-style-type: none"> • Assignments • Oral questioning • Practical tests • Observation • Supervised exercises • Written tests
6. Use of earthing in Electrical installations	<ul style="list-style-type: none"> • Terms in Earthing • Earthing points in Electrical installation • Methods of earthing • Factors to consider in selecting an earthing method • Testing an earthing system 	<ul style="list-style-type: none"> • Assignments • Supervised exercises • Written tests • Practical test
7. Apply lightning protection measures	<ul style="list-style-type: none"> • Meaning of lightning • Lightning strokes and their types • Lightning protection components • Testing a lightning system • Application of lightning system • Maintenance of lightning system 	<ul style="list-style-type: none"> • Assignments • Oral questioning • Supervised exercises • Written tests

8. Apply Electromagnetic field Theory	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Assignments • Oral questioning • Supervised exercises • Written tests
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Suggested methods of instructions

- 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/PO/CC/04/5/A

Relationship to Occupational Standards

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

Duration of Unit: 60 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, producing orthographic and pictorial drawings of components and producing of electrical drawing

Summary of Learning Outcomes

1. Use and maintain drawing equipment and materials
2. Produce plane geometry drawings
3. Produce solid geometry drawings
4. Produce Orthographic drawings
5. Produce pictorial drawings
6. Produce electrical drawings

Learning Outcomes, Content and Suggested Assessment Methods:

Learning Outcome	Content	Suggested Assessment Methods
1. Use and maintain drawing equipment and materials	<ul style="list-style-type: none">• 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)	<ul style="list-style-type: none">• Observation• Oral questioning• Written tests
2. Produce plane geometry drawings	<ul style="list-style-type: none">• Types of lines in drawings• Construction of geometric forms e.g.	<ul style="list-style-type: none">• Oral questioning• Practical tests

	<p>squares, circles</p> <ul style="list-style-type: none"> • Construction of different angles • Measurement of different angles • Bisection of different angles and lines • Standard drawing conventions 	<ul style="list-style-type: none"> • Observation
3. Produce solid geometry drawings	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Observation • Practical tests • Oral questioning
4. Produce orthographic drawings	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Observation • Practical tests • Oral questioning
5. Produce pictorial drawings	<ul style="list-style-type: none"> • Meaning of pictorial drawings • Drawing objects in isometric view • Drawing objects in oblique view 	<ul style="list-style-type: none"> • Observation • Oral questioning • Practical tests
6. Produce electrical drawings	<ul style="list-style-type: none"> • Electrical symbols and abbreviations • Meaning of electrical drawings • Drawing of electrical diagrams e.g. block, schematic, circuit, line and wiring 	<ul style="list-style-type: none"> • Observation • Oral questioning • Practical tests

Suggested methods of instructions

- 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

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CORE UNITS OF LEARNING

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ELECTRICAL INSTALLATION

UNIT CODE: ENG/CU/PO/CR/01/5/A

Relationship to Occupational Standards

This unit addresses the unit of competency: Perform Electrical Installation

Duration of Unit: 60 hours

Unit Description

This unit specifies the competencies required for performing electrical installation.

Competencies required includes; applying EHS Standard, preparation of working drawings, preparation of list of tools equipments and materials, performing of marking, piping and fixing accessories, performing installation, terminating installation testing and inspecting installation.

Summary of Learning Outcomes

1. Apply EHS Standards
2. Prepare working drawings
3. Prepare list of tools, equipment and materials
4. Perform marking, pipe and fixing of accessories
5. Perform Installation
6. Terminate Installation
7. Test and Inspect Installation

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Apply EHS standards	<ul style="list-style-type: none">• 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: <ul style="list-style-type: none">• IEE regulations• KPLC by-laws• County by-laws• Causes of accidents and	<ul style="list-style-type: none">• Written tests• Oral questioning• Observation

Learning Outcome	Content	Suggested Assessment Methods
	<p>sources of danger e.g burns, cuts, electric shock, falling from heights, falling objects, noise, dust, chemicals</p> <ul style="list-style-type: none"> • 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 <p>Methods of resuscitation</p>	
Prepare working drawings	<ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> ➤ Block ➤ Circuits 	<ul style="list-style-type: none"> • Observation • Oral questioning • Practical tests • Written tests

Learning Outcome	Content	Suggested Assessment Methods
	<ul style="list-style-type: none"> ➤ Schematic ➤ Wiring ➤ Line • Reading and Interpretation of architectural drawings <p>Reading and Interpretation of electrical drawings</p>	
Prepare list of tools, equipment and materials	<ul style="list-style-type: none"> • Identification of tools and materials e.g. • Cutting tools • Measuring tools • Measuring equipment • Cables and conductors • Crimping tools • Conduits • Trunking • Consumables • Types, application, care, maintenance and storage of: <ul style="list-style-type: none"> • Tools e.g. <ul style="list-style-type: none"> ➤ 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. <ul style="list-style-type: none"> ➤ Stock and die ➤ Vice • Materials e.g. 	<ul style="list-style-type: none"> • Oral questioning • Written tests • Observation • Practicals

Learning Outcome	Content	Suggested Assessment Methods
	<ul style="list-style-type: none"> ✓ Cables ✓ Fittings ✓ Accessories • Assemble tools, equipment and materials 	
2. Perform marking, piping and fixing of accessories	<ul style="list-style-type: none"> • Meaning of marking, piping, fixing and accessories in electrical installation • Importance of marking • Tools used in marking • Accessories used in Electrical installation e.g. • Lamp holders • Conduits • Ceiling roses • Patress 	<ul style="list-style-type: none"> • Written tests • Observation • Oral questioning • Practical tests
Perform installation	<ul style="list-style-type: none"> • Meaning of terms • Single phase and three phase installation • Domestic Installation • Industrial Installation • Commercial Installation ➤ Phase/load balancing • Cables and cable joints • Wiring systems and accessories <ul style="list-style-type: none"> • Types and applications e.g. ➤ Conduits ➤ Cable trays ➤ Cable ducts ➤ Trunkings • Preparation of wiring systems ➤ Marking out, cutting, bending, threading, chiselling, trenching • Draw –in/Lay of cables routes • Cable Identification • Installation of final circuits 	<ul style="list-style-type: none"> • Written tests • Observation • Oral questioning • Practical test

Learning Outcome	Content	Suggested Assessment Methods
	<ul style="list-style-type: none"> • Lighting circuits <ul style="list-style-type: none"> ➤ One way, two way, intermediate ➤ Looping in methods at ceiling rose, joint boxes, switches • Power circuits <ul style="list-style-type: none"> ➤ Radial circuits, ring circuits • Water heating circuits • Electric cooker circuits • Call and alarm circuits <ul style="list-style-type: none"> ➤ Bell circuits ➤ Intruder alarm circuits • Fire alarm circuits 	
Terminate installation	<ul style="list-style-type: none"> • Meaning of Terms • Importance of termination • Cable labelling • Cable lugging • Tools used in cable termination e.g. • Crimping tool • Strip Knife 	<ul style="list-style-type: none"> • Written tests • Oral questioning • Practical tests <p>Observation</p>
3. Test and inspect installation	<ul style="list-style-type: none"> • Meaning of terms • Types of tests e.g. • Earth continuity tests • Ring circuit test • Insulation tests • Short circuit tests • Testing tools e.g. • Multimeter • Insulation tester • Ohmmeter • Importance of installation testing 	<ul style="list-style-type: none"> • Written tests • Oral questioning • Observation

Suggested Methods of Instruction

- Demonstration by trainer

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

Recommended Resources

- Measuring tools
- Cutting tool
- Drawing tools
- Drilling tools
- Fastening tools
- Stationery
- Assorted Cables
- Assorted protective devices
- Pipes and trunkings
- Cable lugs
- Joints
- Accessories
- PPEs (Personal Protective Equipment)
- Measuring equipment
- Communication equipment

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ELECTRICAL TRANSMISSION POWER LINES

UNIT CODE: ENG/CU/PO/CR/02/5/A

Relationship to Occupational Standards

This unit addresses the unit of competency: Install Electrical power line

Duration of Unit: 90 hours

Unit Description

This unit covers the competencies required to install Electrical power lines and cables: The competencies include; Erect transmission poles, mount transmission cables, terminate conductors and finally test and inspect installation.

Summary of Learning Outcomes

1. Erect transmission lines support
2. Mount transmission lines
3. Terminate transmission line
4. Test and inspect installation

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Erect transmission line support	<ul style="list-style-type: none">• Meaning of transmission line support• Types of supports• Material used in manufacturing of transmission line supports e.g.<ul style="list-style-type: none">• Concrete• Steel• Wooden• Erecting of transmission line support• Application of transmission line	<ul style="list-style-type: none">• Written tests• Oral questioning
2. Mount transmission line	<ul style="list-style-type: none">• Types of transmission line conductors• Equipments used in mounting transmission lines e.g.<ul style="list-style-type: none">• Climbers• Drilling Machine• Transmission line spacing and corona effects	<ul style="list-style-type: none">• Observation• Oral questioning• Written tests

Learning Outcome	Content	Suggested Assessment Methods
	<ul style="list-style-type: none"> • Tension and sag in transmission line • Components used in mounting. transmission lines e.g. • Cross arms • Transformers • Isolators • Insulators • Danger plates • Lightning arrestors • Anti-climbing wire • Cables • Bolts and Nuts • Components used in transmission line protection e.g. • Switch gear • Fuses • Isolators • Circuit breakers • Transmission line protection • Earthing • Lightning arrestors • Surge diverters 	
3. Terminate transmission line	<ul style="list-style-type: none"> • Meaning of transmission line termination • Types of transmission line termination e.g. • AC and DC • End point loads • Type of loads • Cable joints • Types of cable joints • Components used in line termination e.g. • Lugs • Fuses (Droppers) 	<ul style="list-style-type: none"> • Observation • Oral questioning • Written tests
4. Test and inspect transmission installation	<ul style="list-style-type: none"> • Meaning of testing in line transmission • Types of tests in line transmission e.g • Continuity test • Short circuit test 	<ul style="list-style-type: none"> • Written tests • Oral questioning • Practical tests

Learning Outcome	Content	Suggested Assessment Methods
	<ul style="list-style-type: none"> • Insulation test • Earth continuity test • Mechanical strength • Voltage regulation testing and efficiency 	

Suggested Methods of Instructions

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

Recommended Resources

- Computers
- Printers
- Cameras
- Stationery
- Phones

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ELECTRICAL MACHINE INSTALLATION

UNIT CODE: ENG/CU/PO/CR/03/5/A

Relationship to Occupational Standards

This unit addresses the unit of competency: Install Electrical machine

Duration of Unit: 70 hours

Unit Description

This unit covers the competencies required to Install Electrical Machine. Competencies include; mounting electrical machine, mounting machine control panel, laying machine cables, terminating Electrical machine installation and testing of machine installation.

Summary of Learning Outcomes

1. Mount Electrical Machine
2. Mount machine control panel
3. Lay machine cables
4. Terminate Electrical machine installation
5. Test and inspect Electrical machine installation

Learning Outcomes, Content and Suggested Assessment Methods:

Learning Outcome	Content	Suggested Assessment Methods
1. Mount Electrical Machine	<ul style="list-style-type: none">• Meaning of terms• Procedure of mounting an Electrical Machine• Factors to consider in machine mounting• Safety in design of electrical machines layout.• Machine Earthing	<ul style="list-style-type: none">• Observation• Oral questioning• Practical tests• Written tests

2. Mount control panel	<ul style="list-style-type: none"> • Meaning of terms e.g. <ul style="list-style-type: none"> • Interlocking • Control circuit • Main circuits • Components in a control panel e.g. <ul style="list-style-type: none"> • Contactors • Timers • Relays • Circuit breakers • Overload relays • Fuses • Functions of control panel components • Wiring of the control panel components • Labelling the control panel components 	<ul style="list-style-type: none"> • Observation • Oral questioning • Practical tests • Written tests
3. Lay machine cables	<ul style="list-style-type: none"> • Machine cables • Cable colour coding • Factors to consider in laying machine cables • Cable segregation • Importance cable segregation • Factors to consider in cable segregation 	<ul style="list-style-type: none"> • Observation • Oral questioning • Practical tests • Written tests
4. Terminate Electrical Machine Installation	<ul style="list-style-type: none"> • Meaning of Terms • Importance of termination • Cable lugging • Tools and components used in cable termination e.g. <ul style="list-style-type: none"> • Crimping tool • Strip Knife • Connectors • Clips 	<ul style="list-style-type: none"> • Observation • Oral questioning • Practical tests • Written tests

<p>5. Test and Inspect Electrical machine Installation</p>	<ul style="list-style-type: none"> • Meaning of testing • Types of tests in Electrical machine installation e.g. <ul style="list-style-type: none"> • Continuity test • Short circuit test • Insulation test • Earth continuity test • On load and offload tests • Phase sequence rotation 	<ul style="list-style-type: none"> • Written tests • Practical • Oral questioning
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Suggested Methods of Instructions

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

Recommended Resources

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

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ELECTRONICS

UNIT CODE: ENG/CU/PO/CR/04/5/A

Relationship to Occupational Standards

This unit addresses the unit of competency: Demonstrate understanding of Electronics

Duration of Unit: 60 hours

Unit Description

This unit covers the competencies required to demonstrate understanding of Electronics. Competencies includes; Apply semiconductor theory, applying semiconductor diodes, demonstrating understanding of transistors, applying special semiconductor devices, and Performing rectification

Summary of Learning Outcomes

1. Apply semiconductor theory
2. Apply semiconductor diodes
3. Demonstrate understanding of transistors
4. Apply Special semiconductor devices
5. Perform rectification

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Apply semiconductor theory	<ul style="list-style-type: none">• Meaning of terms• Types of materials<ul style="list-style-type: none">• Insulators• Conductors• Semiconductors• Semiconductor materials• Types of semiconductor materials<ul style="list-style-type: none">• Intrinsic and Extrinsic	<ul style="list-style-type: none">• Observation• Oral questioning• Written tests
2. Apply semiconductor diodes	<ul style="list-style-type: none">• Meaning of terms• P-N junction• Semiconductor diodes• Forward and reverse Characteristics• Types of semiconductor diodes• Application of semiconductor diodes	<ul style="list-style-type: none">• Written tests• Oral questioning

Learning Outcome	Content	Suggested Assessment Methods
3. Demonstrate understanding of transistors	<ul style="list-style-type: none"> • Bipolar junction transistors • Operation of NPN and PNP • Field effect transistors • Operation N and P channels • Types of FETs • BJT's and FET's biasing • BJT's and FET's configuration • Characteristics of transistors • Gain of transistors • DC/AC load lines 	<ul style="list-style-type: none"> • Observation • Oral questioning • Written tests
4. Apply Special semiconductor devices	<ul style="list-style-type: none"> • Meaning of terms • Types of special semiconductor devices • UJT • SCR • LASCR • TRIAC • DIAC • SCS • Application of special semiconductor devices 	<ul style="list-style-type: none"> • Observation • Oral questioning • Written tests
5. Perform rectification	<ul style="list-style-type: none"> • Meaning of Terms • Classification of rectifiers • Types of rectifiers • Application of rectifiers 	<ul style="list-style-type: none"> • Written tests • Oral questioning

Suggested Methods of Instruction

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

Recommended Resources

- Computers
- Printers
- Cameras
- Phones
- Stationery

SECURITY SYSTEM INSTALLATION

UNIT CODE: ENG/CU/PO/CR/05/5/A

Relationship to Occupational Standards

This unit addresses the unit of competency: Security System Installation

Duration of Unit: 50 hours

Unit Description

This unit covers the competencies required in installing of security systems. Competencies includes; Marking out of security systems zones, laying system cables, mounting accessories, terminate system cables and testing of the system.

Summary of Learning Outcomes

1. Mark out security system zones or call points
2. Lay system cables
3. Mount accessories
4. Terminate system cables
5. Test security system

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Mark out security system zones and call points	<ul style="list-style-type: none">• Meaning of zones in security system• Types of security systems e.g<ul style="list-style-type: none">• CCTV• Alarms• Electric Fence• Marking, Piping and fixing tools e.g<ul style="list-style-type: none">• Scribers• Pliers• Connectors• Importance of marking	<ul style="list-style-type: none">• Oral questioning• Written tests• Practical tests
2. Lay system cables	<ul style="list-style-type: none">• Types of cables in security system• Factors to consider in security system cable laying• Segregation in cable laying• Importance segregations	<ul style="list-style-type: none">• Observation• Written tests• Oral questioning

Learning Outcome	Content	Suggested Assessment Methods
3. Mount Accessories	<ul style="list-style-type: none"> • Meaning of terms • Accessories used in security system e.g • Smoke sensors • Vibration sensors • Security cameras • Transmitters • Receivers • Cameras • Bell circuits • Intruder alarm • Fire alarm • Call and alarm circuits • Wiring security system • Security system control panels • Insulation classes of enclosures e.g. • IP 44 (Ingress protection) • IP 55 • IP 65 • IP 66 • IP 67 	<ul style="list-style-type: none"> • Observation • Oral questioning • Written tests
4. Terminate System cables	<ul style="list-style-type: none"> • Meaning of termination • Meaning of Terms • Importance of termination • Cable lugging • Tools used in cable termination e.g. <ul style="list-style-type: none"> • Connectors • Strip Knife 	<ul style="list-style-type: none"> • Observation • Oral questioning • Written tests
5. Test Security system	<ul style="list-style-type: none"> • Meaning Testing • Types of tests in security system e.g • Insulation test • Short circuit test • Continuity test • Arming and disarming tests 	<ul style="list-style-type: none"> • Oral questioning • Written tests • Practical test

Suggested Methods of Instruction

- Demonstration by trainer

- Practice by the trainee
- Discussions

Recommended Resources

- Drawing instruments
- Computer
- Stationery

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SOLAR SYSTEM INSTALLATION

UNIT CODE: ENG/CU/PO/CR/06/5/A

Relationship to Occupational Standards

This unit addresses the unit of competency: Install Solar System

Duration of Unit: 30 hours

Unit Description

This unit covers the competencies required to install solar system. Competencies includes; mounting solar panel, fixing solar system components, laying cables, terminating electrical and testing of a solar installation system.

Summary of Learning Outcomes

1. Mount solar Panel
2. Fix solar system accessories
3. Lay out Electrical cables
4. Terminate Electrical cables
5. Test and inspect solar system installation

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Mount Solar panel	<ul style="list-style-type: none">• Meaning of Terms e.g.<ul style="list-style-type: none">✓ Slanting angle✓ Panel Ratings• Solar panel positioning• Types of Solar panels e.g.<ul style="list-style-type: none">✓ PV Solar• Vacuum tube• Monocrystalline• Polycrystalline• Factors to consider in solar panel Selection and installation	<ul style="list-style-type: none">• Observation• Oral questioning• Practical tests• Written tests

2. Fix solar system components	<ul style="list-style-type: none"> • Methods of solar panel connection <ul style="list-style-type: none"> ✓ Parallel and series • Solar panel components <ul style="list-style-type: none"> ✓ Charger controller ✓ Inverters ✓ Solar batteries ✓ Cables • Types of charge controllers e.g. <ul style="list-style-type: none"> ✓ Pulse width Modulated ✓ Maximum power point tracking. ✓ Simple one or two stage controls 	<ul style="list-style-type: none"> • Observation • Oral questioning • Written tests
3. Lay Electrical cables	<ul style="list-style-type: none"> • Cable laying tools • Cable segregation • Cable labelling 	<ul style="list-style-type: none"> • Observation • Oral questioning • Practical tests • Written tests
4. Terminate Electrical cables	<ul style="list-style-type: none"> • Meaning of terms • Cable lugging • Cable connectors 	<ul style="list-style-type: none"> • Observation • Oral questioning • Practical tests • Written tests
5. Test Solar system installation	<ul style="list-style-type: none"> • Meaning of test • Types of tests <ul style="list-style-type: none"> ✓ Insulation resistant test ✓ Short circuit test ✓ Ring circuit test ✓ Continuity test ✓ Earth continuity test ✓ Firmness test 	<ul style="list-style-type: none"> • 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

- Set of screw drivers

- Set of spanners and wrenches
- Power tools
- Cutting tools
- Pliers
- Lifting and tensioning tools
- Tool box
- Phase tester
- PPE –hand gloves, dust coat, dust masks
- Multimeter
- Clamp meter
- Earth electrode resistance meter
- Phase sequence meter
- Stationery
- Cables
- Lubricants
- Service parts

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ELECTRICAL BREAKDOWN MAINTENANCE

UNIT CODE: ENG/CU/PO/CR/07/5/A

Relationship to Occupational Standards

This unit addresses the unit of competency: Conduct Electrical Breakdown Maintenance

Duration of Unit: 60 hours

Unit Description

This unit specifies the competencies required to conduct breakdown maintenance of an electrical installation. The competencies include; Identifying the system failure, preparing the list of tools, equipment and materials, Troubleshooting the cause of failure, repairing the system, testing the system, and documenting the maintenance report.

Summary of Learning Outcomes

1. Identify system failure
2. Prepare list of tools, equipment, and materials
3. Troubleshoot cause of failure
4. Repair the system
5. Test the system
6. Document maintenance report

Learning Outcomes, Content and Suggested Assessment Methods:

Learning Outcome	Content	Suggested Assessment Methods
1. Identify system failure	<ul style="list-style-type: none">• Gathering information<ul style="list-style-type: none">• Principle of operation• Visual inspection• Interview of users• Types of failures e.g<ul style="list-style-type: none">• Partial• Total• Electrical• Mechanical• Referring to as-built drawings, Manuals	<ul style="list-style-type: none">• Oral questioning• Written tests• Observation
2. Prepare list of tools, equipment and materials	<ul style="list-style-type: none">• Identification of tools, equipment and materials for troubleshooting and repair/replace	<ul style="list-style-type: none">• Observation• Oral questioning• Practical tests

	<ul style="list-style-type: none"> • Specification of tools e.g troubleshooting tools. 	<ul style="list-style-type: none"> • Written tests
3. Troubleshoot cause of failure.	<ul style="list-style-type: none"> • Safety standards <ul style="list-style-type: none"> • PPE • Troubleshooting procedure • Conducting fault diagnosis e.g. <ul style="list-style-type: none"> • Open circuit • Short circuit • Earth fault • Mechanical fault • Recording of system failure results <ul style="list-style-type: none"> • Parameters e.g. <ul style="list-style-type: none"> ➤ Voltage ➤ Current ➤ Resistance 	<ul style="list-style-type: none"> • Oral questioning • Practical tests • Written tests
4. Repair the system	<ul style="list-style-type: none"> • Repair/Replace <ul style="list-style-type: none"> • Meaning • Isolating the faulty part • Conducting repair/replace activities • Recording repair activities • Waste disposal 	<ul style="list-style-type: none"> • Observation • Oral questioning • Practical tests • Written tests
5. Test the system	<ul style="list-style-type: none"> • Identification of test and test points <ul style="list-style-type: none"> • Test parameters e.g. <ul style="list-style-type: none"> ➤ Voltage ➤ Resistance ➤ Current • Testing, documenting results and maintenance report writing 	<ul style="list-style-type: none"> • Practical tests • Observation • Oral questioning
6. Document maintenance report	<ul style="list-style-type: none"> • Maintenance report • Preparation of maintenance report • Filing of maintenance report • Importance of maintenance reports. 	<ul style="list-style-type: none"> • Written tests • Oral questioning • Practical tests

Suggested Methods of Instructions

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

Recommended Resources

- Set of screw drivers
- Pliers
- Phase testers
- Multimeter
- PPE –hand gloves, dust coat, dust masks
- Multimeter
- Clamp meter
- Earth electrode resistance meter
- Phase sequence meter
- Stationery
- Cables
- Lubricants
- Service parts

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