



# **THE KISII NATIONAL POLYTECHNIC**

**P.O. BOX 222-40200,**

**KISII, KENYA.**

**DEPARTMENT OF ELECTRICAL AND  
ELECTRONIC ENGINEERING**

**COMPETENCY BASED CURRICULUM**

**FOR**

**ELECTRICAL INSTALLATION ARTISAN**

**LEVEL 4**

## TABLE OF CONTENT

ACRONYMNS AND ABBREVIATIONS .....	3
OVERVIEW .....	4
BASIC UNITS OF LEARNING .....	6
COMPUTER APPLICATIONS .....	10
ENTREPRENEURSHIP SKILLS .....	12
EMPLOYABILITY SKILLS.....	15
OCCUPATIONAL SAFETY AND HEALTH PRACTICES .....	18
Learning Outcomes, Content and Suggested Assessment Methods .....	18
TECHNICAL DRAWING AND WORKSHOP TECHNOLOGY .....	23
ELECTRICAL PRINCIPLES .....	26
CORE UNITS OF LEARNING.....	29
PERFORM ELECTRICAL INSTALLATION .....	30
TESTING OF ELECTRICAL INSTALLATION .....	35
ELECTRICAL INSTALLATION BREAKDOWN MAINTENANCE.....	38

## ACRONYMNS AND ABBREVIATIONS

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

## OVERVIEW

### Description of the course

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

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

### Basic Units of Learning

Unit Code	Unit Title	Duration in Hours	Credit factors
EIBC001	Communication skills	20	2
EIBC002	Computer applications	30	3
EIBC003	Entrepreneurship skills	60	6
EIBC004	Employability skills	30	3
EIBC005	Environmental literacy	20	2
EIBC006	Occupational safety and health practices	20	2
<b>Total</b>		<b>180</b>	<b>18</b>

### Common Units of Learning

Unit Code	Unit Title	Duration in Hours	Credit Factors
EICC001	Engineering Mathematics	50	5
EICC002	Electrical principles	80	8
EICC003	Technical Drawing and Workshop Technology	40	4
<b>Total</b>		<b>170</b>	<b>17</b>

### Core Units of Learning

Unit Code	Unit Title	Duration in Hours	Credit factors
EICR001	Perform Electrical Installation	180	18
EICR002	Testing of Electrical Installation	30	3
EICR003	Electrical Installation Breakdown Maintenance	40	4
	Total	250	25
	Industrial Attachment	300	30
<b>Total</b>		<b>600</b>	<b>600</b>

<b>GRAND TOTAL</b>	<b>900</b>	<b>900</b>
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The total duration of the course is **900** hours, inclusive of industrial attachment

### **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.) mean grade D-(minus)
- Or**
- b) Level 3 certificate in electrical installation with **one** year of continuous work experience
- Or**
- c) Equivalent qualifications as determined by Kenya National Qualifications Authority (KNQA)

#### **1. 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 300 hours. Attachment will be undertaken upon completion of the units of learning.

#### **2. Assessment**

The course will be assessed through supervised practical exercises, continuous assessment tests and a terminal written/practical examination prepared and marked as per KNP academic policy.

A candidate will be issued with a Record of Achievement on demonstration of competence in a unit of competency. To attain the qualification Electrical Installation Artisan Level 4, the candidate must demonstrate competence in all the units of competency as given in qualification pack. These certificates will be issued by KNP.

## **BASIC UNITS OF LEARNING**

## COMMUNICATION SKILLS

**UNIT CODE:** EIBC001

### Unit Description

This unit describes the competencies required to lead in the dissemination and discussion of ideas, information and issues in the workplace.

### Learning Outcomes

By the end of this unit, the trainee will be able to:

1. Obtain and convey workplace information
2. Complete relevant work-related documents
3. Communicate information about workplace processes
4. Lead workplace discussion
5. Identify and communicate issues arising in the workplace

### Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Obtain and convey workplace information	<ul style="list-style-type: none"><li>• Communication process</li><li>• Modes of communication</li><li>• Medium of communication</li><li>• Effective communication</li><li>• Barriers to communication</li><li>• Flow of communication</li><li>• Sources of information</li><li>• Types of questions</li><li>• Organizational policies</li><li>• Workplace etiquette</li><li>• Ethical work practices in handling communication</li></ul>	<ul style="list-style-type: none"><li>• Observation</li><li>• Interview</li><li>• Third party reports</li></ul>
2. Complete relevant work-related documents	<ul style="list-style-type: none"><li>• Types and purposes of workplace documents and forms</li><li>• Methods used in filling forms and documents</li><li>• Recording workplace data</li><li>• Process of distributing workplace forms and documents</li></ul>	<ul style="list-style-type: none"><li>• Observation</li><li>• Interview</li><li>• Third party reports</li></ul>

	<ul style="list-style-type: none"> <li>• Report writing</li> <li>• Types of workplace reports</li> </ul>	
3. Communicate information about workplace processes	<ul style="list-style-type: none"> <li>• Communication process</li> <li>• Modes of communication</li> <li>• Medium of communication</li> <li>• Effective communication</li> <li>• Barriers to communication</li> <li>• Flow of communication</li> <li>• Sources of information</li> <li>• Organizational policies</li> <li>• Organization requirements for written and electronic communication methods</li> <li>• Report writing</li> <li>• Effective questioning techniques (clarifying and probing)</li> <li>• Workplace etiquette</li> <li>• Ethical work practices in handling communication</li> </ul>	<ul style="list-style-type: none"> <li>• Observation</li> <li>• Interview</li> <li>• Portfolio</li> </ul>
4. Lead workplace discussion	<ul style="list-style-type: none"> <li>• Methods of discussion e.g. <ul style="list-style-type: none"> <li>✓ Coordination meetings</li> <li>✓ Toolbox discussion</li> <li>✓ Peer-to-peer discussion</li> </ul> </li> <li>• Solicitation of response</li> </ul>	<ul style="list-style-type: none"> <li>• Observation</li> <li>• Interview</li> <li>• Third party reports</li> </ul>
5. Identify and communicate issues arising in the workplace	<ul style="list-style-type: none"> <li>• Identification of problems and issues</li> <li>• Organizing information on problems and issues</li> <li>• Relating problems and issues</li> <li>• Communication barriers affecting workplace discussions</li> </ul>	<ul style="list-style-type: none"> <li>• Observation</li> <li>• Interview</li> <li>• Portfolio</li> </ul>

### Suggested Delivery Methods

- Discussion

- Role play
- Brainstorming

### **Recommended Resources**

- Desktop computers/laptops
- Internet connection
- Projectors and screens
- Mobile phones
- Report writing templates

# COMPUTER APPLICATIONS

**UNIT CODE:** EIBC002

## Unit Description

This unit covers the competencies required to effectively demonstrate digital literacy in a working environment. It entails identifying and using digital devices such as smartphones, tablets, laptops and desktop PCs for purposes of communication and performing work related tasks at the work place.

## Learning Outcomes

By the end of this unit, the trainee will be able to:

1. Identify computer hardware and software
2. Apply security measures to data, hardware and software
3. Apply computer software in solving tasks
4. Apply internet and email in communication at workplace

## 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"><li>• Meaning of a computer</li><li>• Functions of a computer</li><li>• Components of a computer</li><li>• Classification of computers</li></ul>	<ul style="list-style-type: none"><li>• Written</li><li>• Oral</li><li>• Observation</li></ul>
2. Apply security measures to data, hardware and software	<ul style="list-style-type: none"><li>• Data security and control</li><li>• Security threats and control measures</li><li>• Types of computer crimes</li><li>• Detection and protection against computer crimes</li></ul>	<ul style="list-style-type: none"><li>• Written tests</li><li>• Oral presentation</li><li>• Observation</li><li>• Projects</li></ul>
3. Apply computer software in solving tasks	<ul style="list-style-type: none"><li>• Operating system</li><li>• Word processing</li><li>• Spread sheets</li><li>• Data base</li></ul>	<ul style="list-style-type: none"><li>• Oral questioning</li><li>• Observation</li><li>• Project</li></ul>
4. Apply internet and email in communication at workplace	<ul style="list-style-type: none"><li>• Computer networks</li><li>• Uses of internet</li><li>• Electronic mail (e-mail) concept</li></ul>	<ul style="list-style-type: none"><li>• Oral questioning</li><li>• Observation</li><li>• Oral presentation</li><li>• Written report</li></ul>

## Suggested Delivery Methods

- Instructor led facilitation of theory

- Demonstration by trainer
- Practical work by trainee
- Viewing of related videos
- Project
- Group discussions

### **Recommended Resources**

- Desk top computers
- Laptop computers
- Other digital devices
- Printers
- Storage devices
- Internet access
- Computer software

# ENTREPRENEURSHIP SKILLS

UNIT CODE: EIBC003

## Unit description

This unit describes the competencies critical to demonstration of entrepreneurial skills. It includes creating and maintaining small scale business, establishing small scale business customer base, managing and growing a small business.

## Learning Outcomes

By the end of this unit, the trainee will be able to:

1. Create and maintain small scale business
2. Establish small scale business customer base
3. Manage small scale business
4. Grow/ expand small scale business

## Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Create and maintain small scale business	<ul style="list-style-type: none"><li>• Starting a small business</li><li>• Legal regulatory requirements in starting a small business</li><li>• SWOT/ PESTEL analysis</li><li>• Conducting market/industry survey</li><li>• Generation and evaluation of business ideas</li><li>• Matching competencies with business opportunities</li><li>• Forms of business ownership</li><li>• Location of a small business</li><li>• Legal and regulatory requirement</li><li>• Resources required to start a small business</li><li>• Common terminologies in entrepreneurship</li><li>• Entrepreneurship in national development</li><li>• Self-employment</li></ul>	<ul style="list-style-type: none"><li>• Observation</li><li>• Case studies</li><li>• Individual/group assignments</li><li>• projects</li><li>• Written</li><li>• Oral</li></ul>

	<ul style="list-style-type: none"> <li>• Formal and informal employment</li> <li>• Entrepreneurial culture</li> <li>• Myths associated with entrepreneurship</li> <li>• Types, characteristics, qualities &amp; role of entrepreneurs</li> <li>• History, development and importance of entrepreneurship</li> <li>• Theories of entrepreneurship</li> <li>• Quality assurance for small businesses</li> <li>• Policies and procedures on occupational safety and health and environmental concerns</li> </ul>	
2. Establish small scale business customer base	<ul style="list-style-type: none"> <li>• Good staff/workers and customer relations</li> <li>• Marketing strategy</li> <li>• Identifying and maintain new customers and markets</li> <li>• Product/ service promotions</li> <li>• Products / services diversification</li> <li>• SWOT / PESTEL analysis</li> <li>• Conducting a business survey</li> <li>• Generating Business ideas</li> <li>• Business opportunities</li> </ul>	<ul style="list-style-type: none"> <li>• Observation</li> <li>• Case studies</li> <li>• Individual/group assignments</li> <li>• projects</li> <li>• Written</li> <li>• Oral</li> </ul>
3. Manage small scale business	<ul style="list-style-type: none"> <li>• Organization of a small business</li> <li>• Small business' business plan</li> <li>• Marketing for small businesses</li> <li>• Managing finances for small business</li> <li>• Production/ operation process for goods/services</li> </ul>	<ul style="list-style-type: none"> <li>• Oral</li> <li>• Observation</li> <li>• Case studies</li> <li>• Individual/group assignments</li> <li>• projects</li> <li>• Written</li> </ul>

	<ul style="list-style-type: none"> <li>• Small business records management</li> <li>• Book keeping and auditing for small businesses</li> <li>• Business support services</li> <li>• Small business resources mobilization and utilization</li> <li>• Basic business social responsibility</li> <li>• Management of small business</li> <li>• Word processing concepts in small business management</li> <li>• Computer application software</li> <li>• Monitoring and controlling business operations</li> </ul>	
4. Grow/expand small scale business	<ul style="list-style-type: none"> <li>• Methods of growing small business</li> <li>• Resources for growing small business</li> <li>• Small business growth plan</li> <li>• Computer software in business development</li> <li>• ICT and business growth</li> </ul>	<ul style="list-style-type: none"> <li>• Observation</li> <li>• Case studies</li> <li>• Individual/group assignments</li> <li>• projects</li> <li>• Written</li> </ul>

#### **Suggested Delivery Methods**

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

#### **Recommended Resources**

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

- Telephone
- Writing materials
- Charts and pictures

## **EMPLOYABILITY SKILLS**

**UNIT CODE: EIBC005**

### **Unit Description**

This unit covers competencies required to demonstrate employability skills. It involves conducting self-management, demonstrating critical safe work habits, demonstrating workplace learning and workplace ethics.

### **Learning Outcomes**

By the end of this unit, the trainee will be able to:

1. Conduct self-management
2. Demonstrate critical safe work habits
3. Demonstrate workplace learning
4. Demonstrate workplace ethics

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

<b>Learning Outcome</b>	<b>Content</b>	<b>Suggested Assessment Methods</b>
1. Conduct self-management	<ul style="list-style-type: none"> <li>❖ Self-awareness</li> <li>❖ Formulating personal vision, mission and goals</li> <li>❖ Strategies for overcoming life challenges</li> <li>❖ Emotional intelligence</li> <li>❖ Assertiveness</li> <li>❖ Expressing personal thoughts, feelings and beliefs</li> <li>❖ Developing and maintaining high self-esteem</li> <li>❖ Developing and maintaining positive self-image</li> <li>❖ Articulating ideas and aspirations</li> <li>❖ Accountability and responsibility</li> <li>❖ Good work habits</li> <li>❖ Self-awareness</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Observation</li> <li><input type="checkbox"/> Written</li> <li><input type="checkbox"/> Oral interview</li> <li><input type="checkbox"/> Third party report</li> </ul>

	<ul style="list-style-type: none"> <li>❖ Self-development</li> <li>❖ Financial literacy</li> <li>❖ Healthy lifestyle practices</li> </ul>	
2. Demonstrate critical safe work habits	<ul style="list-style-type: none"> <li>❖ Stress and stress management</li> <li>❖ Punctuality and time consciousness</li> <li>❖ Interpersonal communication</li> <li>❖ Sharing information</li> <li>❖ Leisure</li> <li>❖ Integrating personal objectives into organizational objectives</li> <li>❖ Resources utilization</li> <li>❖ Setting work priorities</li> <li>❖ HIV and AIDS</li> <li>❖ Drug and substance abuse</li> <li>❖ Handling emerging issues</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Observation</li> <li><input type="checkbox"/> Written</li> <li><input type="checkbox"/> Oral interview</li> <li><input type="checkbox"/> Third party report</li> </ul>
3. Demonstrate workplace learning	<ul style="list-style-type: none"> <li>❖ Personal training needs identification and assessment</li> <li>❖ Managing own learning</li> <li>❖ Contributing to the learning community at the workplace</li> <li>❖ Cultural aspects of work</li> <li>❖ Variety of learning context</li> <li>❖ Application of learning</li> <li>❖ Safe use of technology</li> <li>❖ Identifying opportunities</li> <li>❖ Workplace innovation</li> <li>❖ Performance improvement</li> <li>❖ Handling emerging issues</li> <li>❖ Future trends and concerns in learning</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Observation</li> <li><input type="checkbox"/> Oral interview</li> <li><input type="checkbox"/> Written</li> <li><input type="checkbox"/> Third party report</li> </ul>
4. Demonstrate workplace ethics	<ul style="list-style-type: none"> <li>❖ Meaning of ethics</li> <li>❖ Ethical perspectives</li> <li>❖ Principles of ethics</li> <li>❖ Values and beliefs</li> <li>❖ Ethical standards</li> <li>❖ Organization code of ethics</li> <li>❖ Common ethical dilemmas</li> <li>❖ Organization culture</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Observation</li> <li><input type="checkbox"/> Oral interview</li> <li><input type="checkbox"/> Written</li> <li><input type="checkbox"/> Third party report</li> </ul>

	<ul style="list-style-type: none"> <li>❖ Corruption, bribery and conflict of interest</li> <li>❖ Privacy and data protection</li> <li>❖ Diversity, harassment and mutual respect</li> <li>❖ Financial responsibility/accountability</li> <li>❖ Etiquette</li> <li>❖ Personal and professional integrity</li> <li>❖ Commitment to jurisdictional laws</li> <li>❖ Emerging issues in ethics</li> </ul>	
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### **Suggested Methods of Delivery**

- Instructor lead facilitation of theory
- Demonstrations
- Simulation/Role play
- Group Discussion
- Presentations
- Projects
- Case studies
- Assignments

### **Recommended Resources**

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

# OCCUPATIONAL SAFETY AND HEALTH PRACTICES

UNIT CODE:EIBC006

## Unit Description

This unit describes the competencies required to practice safety and health, and comply with OSH requirements relevant to work.

## Summary of Learning Outcomes

1. Observe workplace procedures for hazards and risk prevention
2. Participate in arrangements for workplace safety and health maintenance

## Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Observe workplace procedures for hazards and risk prevention	<ul style="list-style-type: none"><li>• Arrangement of work area and items in accordance with Company housekeeping procedures</li><li>• Adherence to work standards and procedures</li><li>• Application of preventive and control measures, including use of safety gears/PPE</li><li>• Study and apply standards and procedures for incidents and emergencies.</li><li>• Occupational safety and health act (OSHA)</li><li>•</li></ul>	<ul style="list-style-type: none"><li>• Oral questions</li><li>• Written questions</li><li>• Observation of work procedures</li></ul>
2. Participate in arrangements for workplace safety	<ul style="list-style-type: none"><li>• Participating in orientations on OSH requirements/regulations of tasks</li></ul>	<ul style="list-style-type: none"><li>• Oral questions</li><li>• Written tests</li><li>• Practical test</li></ul>

and health maintenance	<ul style="list-style-type: none"> <li>• Providing feedback on health, safety, and security concerns to appropriate personnel as required in a sufficiently detailed manner</li> <li>• Practice workplace procedures for reporting hazards, incidents, injuries and sickness</li> <li>• OSH requirements/ regulations and workplace safety and hazard control procedures are reviewed, and compliance reported to appropriate personnel</li> <li>• Identification of needed OSH-related trainings are proposed to appropriate personnel</li> </ul>	<ul style="list-style-type: none"> <li>• Observation of practical work by trainees</li> </ul>
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#### **Suggested Delivery Methods**

- Instructor-led facilitation of theory
- Practical demonstration of tasks by trainer
- Practice by trainees/ role play
- Discussion
- Observations and comments and corrections by trainers
- Anti-static suits
- High-visibility reflective vest

#### **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

## **COMMON UNITS OF LEARNING**

# ENGINEERING MATHEMATICS

UNIT CODE: EICC001

## Unit Description

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

## Learning Outcomes

By the end of this unit, the trainee will be able to:

1. Apply Algebra
2. Apply Statistics
3. Carry out Mensuration
4. Apply Matrix
5. Apply Vectors

## Learning Outcomes, Content and Suggested Assessment Methods

Building Technology Curriculum		
Learning Outcome	Content	Suggested Assessment Methods
1. Apply Algebra	<ul style="list-style-type: none"><li>❖ Base and Index</li><li>❖ Laws of indices</li><li>❖ Indicial equations</li><li>❖ Laws of logarithm</li><li>❖ Logarithmic equations</li><li>❖ Conversion of bases</li><li>❖ Use of calculator</li></ul>	<ul style="list-style-type: none"><li>❖ Written tests</li><li>❖ Oral questioning</li><li>❖ Assignments</li><li>❖ Supervised exercises</li></ul>

	<ul style="list-style-type: none"> <li>❖ Solutions of simultaneous linear equations with two unknowns</li> <li>❖ Solution of quadratic equations</li> </ul>	
2. Apply Statistics	<ul style="list-style-type: none"> <li>❖ Definition</li> <li>❖ Data collection</li> <li>❖ Data organization</li> <li>❖ Frequency distribution table</li> <li>❖ Data presentation</li> <li>❖ Measures of Central tendency</li> </ul>	<ul style="list-style-type: none"> <li>❖ Written tests</li> <li>❖ Oral questioning</li> <li>❖ Assignments</li> <li>❖ Supervised exercises</li> </ul>
3. Carry out Mensuration	<ul style="list-style-type: none"> <li>❖ Units of measurements</li> <li>❖ Perimeter and areas of regular figures</li> <li>❖ Volume of regular solids</li> <li>❖ Surface area of regular solids</li> </ul>	<ul style="list-style-type: none"> <li>❖ Written tests</li> <li>❖ Oral questioning</li> <li>❖ Assignments</li> <li>❖ Supervised exercises</li> </ul>
4. Apply Matrix methods	<ul style="list-style-type: none"> <li>❖ Matrix operation</li> <li>❖ Determinant of 2x2 matrix</li> <li>❖ Inverse of 2x2 matrix</li> <li>❖ Solution of linear simultaneous equations in 2 unknowns</li> </ul>	<ul style="list-style-type: none"> <li>❖ Assignments</li> <li>❖ Oral questioning</li> <li>❖ Supervised exercises</li> <li>❖ Written tests</li> </ul>
5. Apply Vectors	<ul style="list-style-type: none"> <li>❖ Vectors and scalar in two dimensions</li> <li>❖ Operations on vectors: Addition, Subtraction and Multiplication.</li> </ul>	<ul style="list-style-type: none"> <li>❖ Assignments</li> <li>❖ Oral questioning</li> <li>❖ Supervised exercises</li> <li>❖ Written tests</li> </ul>

### Suggested Delivery Methods

- Group discussions
- Demonstration by trainer
- Exercises by trainee

### Recommended Resources

- Scientific Calculators
- Rulers, pencils, erasers
- Charts with presentations of data
- Graph book

# TECHNICAL DRAWING AND WORKSHOP TECHNOLOGY

UNIT CODE: EICC002

## Unit Description

This unit covers the competencies required to prepare and interpret technical drawings and manage an Electrical workshop. It involves competencies to: select, use and maintain drawing equipment and materials; produce plain geometry drawings, solid geometry drawings, orthographic drawings of components and Electrical drawings. It also involves applying workshop safety, troubleshoot and repair/replace workshop tools and equipment.

## Learning Outcomes

By the end of this unit, the trainee will be able to:

1. Use and maintenance of drawing equipment and materials
2. Produce plane geometry drawings
3. Produce solid geometry drawings
4. Produce orthographic drawings
5. Produce Electrical drawings
6. Apply workshop safety
7. Troubleshoot and repair workshop tools and equipment

## Learning Outcomes, Content and Suggested Assessment Methods:

Learning Outcome	Content	Suggested Assessment Methods
1. Use and maintenance of drawing equipment and materials	<ul style="list-style-type: none"><li>❖ Identification and care of drawing equipment</li><li>❖ Identification and care of drawing materials</li><li>❖ Drawing paper layout</li></ul>	<ul style="list-style-type: none"><li>❖ Observation</li><li>❖ Oral questioning</li><li>❖ Written tests</li></ul>

2. Produce plane geometry drawings	<ul style="list-style-type: none"> <li>❖ Types of lines in drawings</li> <li>❖ Construction of geometric forms: <ul style="list-style-type: none"> <li>• Quadrilaterals</li> <li>• Circles</li> <li>• Polygons using the general methods</li> </ul> </li> <li>❖ Construction of different angles</li> <li>❖ Bisection of different angles and lines</li> <li>❖ Free hand sketching</li> </ul>	<ul style="list-style-type: none"> <li>❖ Oral questioning</li> <li>❖ Practical tests</li> <li>❖ Observation</li> </ul>
3. Produce solid geometry drawings	<ul style="list-style-type: none"> <li>❖ Interpretation of sketches</li> <li>❖ Sectioning of solids: <ul style="list-style-type: none"> <li>• Prisms</li> <li>• Cones</li> <li>• Cylinders</li> </ul> </li> <li>❖ Development and interpenetrations of solids: <ul style="list-style-type: none"> <li>• cylinder to cylinder</li> <li>• cylinder to triangular prism</li> <li>• Cylinder to square prism</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>❖ Observation</li> <li>❖ Practical tests</li> <li>❖ Oral questioning</li> </ul>
4. Produce orthographic drawings	<ul style="list-style-type: none"> <li>❖ Meaning of pictorial and orthographic drawings</li> <li>❖ Drawing of 1<sup>st</sup> and 3<sup>rd</sup> angle projections</li> <li>❖ Drawing and interpretation of 1<sup>st</sup> and 3<sup>rd</sup> angle orthographic elevations</li> <li>❖ Dimensioning of orthographic elevations</li> </ul>	<ul style="list-style-type: none"> <li>❖ Observation</li> <li>❖ Practical tests</li> <li>❖ Oral questioning</li> </ul>
5. Produce electrical drawings	<ul style="list-style-type: none"> <li>❖ Drawing of electrical symbols</li> <li>❖ Drawing of electrical diagrams: <ul style="list-style-type: none"> <li>• Block</li> <li>• Schematic</li> <li>• circuit and wiring</li> </ul> </li> <li>❖ Interpretation of electrical drawings</li> </ul>	<ul style="list-style-type: none"> <li>❖ Oral questioning</li> <li>❖ Written tests</li> <li>❖ Practical test</li> </ul>
6. Apply workshop safety	<ul style="list-style-type: none"> <li>❖ Meaning of PPE <ul style="list-style-type: none"> <li>• Standard operating procedure in PPE</li> </ul> </li> <li>❖ Workshop rules</li> <li>❖ Electrical hazards <ul style="list-style-type: none"> <li>• Electric shock.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>❖ Oral questioning</li> <li>❖ Written tests</li> <li>❖ Practical test</li> </ul>

	<ul style="list-style-type: none"> <li>• Electric burns</li> <li>• Fire <ul style="list-style-type: none"> <li>○ Classes of fire</li> <li>○ Causes of fire</li> <li>○ Various methods of fire extinguishing</li> </ul> </li> </ul>	
	❖ First Aid	
7. Manage an electrical workshop	<ul style="list-style-type: none"> <li>❖ Classification of workshop tools, instruments and equipment</li> <li>❖ Storage of workshop tools and equipment</li> <li>❖ Care and maintenance of workshop tools, instruments and equipment</li> </ul>	<ul style="list-style-type: none"> <li>❖ Oral questioning</li> <li>❖ Observation</li> <li>❖ Practical tests</li> <li>❖ Written tests</li> </ul>
8. Troubleshoot and repair/replace workshop tools and equipment	<ul style="list-style-type: none"> <li>❖ Meaning of troubleshooting</li> <li>❖ Common faults in Electrical equipment</li> <li>❖ Fault diagnosis procedure</li> <li>❖ Repair/Replace of components in Electrical equipment</li> <li>❖ Waste disposal</li> <li>❖ Calibration and service of equipment</li> </ul>	<ul style="list-style-type: none"> <li>❖ Observation</li> <li>❖ Oral questioning</li> <li>❖ Practical tests</li> <li>❖ Written tests</li> </ul>

### Suggested Methods of Delivery

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

### Recommended Resources

- Standard drawing room
- Drawing instruments: T-squares, set squares, drawing sets
- Drawing tables
- Pencils, papers, erasers
- Masking tapes
- PPEs – hand gloves, dust coat, dust masks
- Different electrical test equipment
- Lubricants
- Service parts

# ELECTRICAL PRINCIPLES

UNIT CODE: EICC003

## 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; Basic Electrical quantities, D.C and A.C circuits in electrical installation, electrical machines, capacitance and inductance

## Learning Outcomes

By the end of this unit, the trainee will be able to:

1. Basic Electrical quantities
2. D.C and A.C circuits in electrical installation
3. Electrical machines
4. Capacitance and inductance

## Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Basic Electrical quantities	<ul style="list-style-type: none"><li>❖ The meaning of SI unit</li><li>❖ Meaning and SI unit of basic Electrical quantities<ul style="list-style-type: none"><li>• Charge</li><li>• Current</li><li>• Voltage</li><li>• Resistance</li><li>• Power</li><li>• Energy</li></ul></li><li>❖ Ohm's law and its application</li><li>❖ Instruments and their use in measuring Electrical quantities</li></ul>	<ul style="list-style-type: none"><li>❖ Written tests</li><li>❖ Oral questioning</li><li>❖ Assignments</li><li>❖ Supervised exercises</li></ul>
2. D.C and A.C circuits in electrical installation	<ul style="list-style-type: none"><li>❖ Meaning of the terms<ul style="list-style-type: none"><li>• DC</li><li>• AC</li></ul></li><li>❖ Basic Electric circuit<ul style="list-style-type: none"><li>• Components</li><li>• Open circuit</li><li>• Closed circuit</li><li>• Short circuit</li></ul></li></ul>	<ul style="list-style-type: none"><li>❖ Written tests</li><li>❖ Oral questioning</li><li>❖ Assignments</li><li>❖ Supervised exercises</li></ul>

	<ul style="list-style-type: none"> <li>❖ Conductors and insulators</li> <li>❖ Resistance variation</li> <li>❖ Resistors and color coding</li> <li>❖ DC circuits; calculations involving basic electrical quantities in <ul style="list-style-type: none"> <li>• Series circuits</li> <li>• Parallel circuits</li> <li>• Series and parallel circuits</li> </ul> </li> <li>❖ AC resistive(R) circuits <ul style="list-style-type: none"> <li>• AC and DC network theorems ; Kirchoff's laws</li> </ul> </li> </ul>	
3. Capacitance	<ul style="list-style-type: none"> <li>❖ Meaning of electrostatic field <ul style="list-style-type: none"> <li>• Sources of electrostatic field</li> </ul> </li> <li>❖ Meaning of terms <ul style="list-style-type: none"> <li>• Electric field strength</li> <li>• Capacitance</li> <li>• Capacitors</li> <li>• Electric flux density</li> <li>• Permittivity</li> </ul> </li> <li>❖ Types of capacitors</li> <li>❖ Charging and discharging</li> <li>❖ Capacitors connection <ul style="list-style-type: none"> <li>• Series</li> <li>• Parallel</li> <li>• Parallel and series</li> </ul> </li> <li>❖ Application of capacitors</li> <li>❖ Calculations involving capacitors</li> </ul>	<ul style="list-style-type: none"> <li>❖ Assignments</li> <li>❖ Oral questioning</li> <li>❖ Supervised exercises</li> <li>❖ Written tests</li> </ul>
4. Inductance	<ul style="list-style-type: none"> <li>❖ Magnetic circuits</li> <li>❖ Magnetic fields <ul style="list-style-type: none"> <li>• Magnetic flux and flux density</li> <li>• Magnetomotive force and magnetic field strength</li> <li>• Permeability and B-H curves</li> <li>• Hysteresis and hysteresis losses</li> </ul> </li> <li>❖ Force on current-carrying conductor</li> </ul>	<ul style="list-style-type: none"> <li>❖ Assignments</li> <li>❖ Oral questioning</li> <li>❖ Supervised exercises</li> <li>❖ Written tests</li> <li>❖</li> </ul>

	<ul style="list-style-type: none"> <li>❖ Principle of operation of a simple DC motor</li> <li>❖ Principle of operation of a moving coil instrument</li> <li>❖ Electromagnetic field and electromagnets</li> <li>❖ Electromagnetic induction <ul style="list-style-type: none"> <li>• Laws of electromagnetic induction</li> <li>• Rotation of a loop in a magnetic field</li> </ul> </li> <li>❖ Inductance and inductors</li> <li>❖ Inductor connections <ul style="list-style-type: none"> <li>• Series</li> <li>• Parallel</li> <li>• Parallel and series</li> </ul> </li> <li>❖ Applications of inductors</li> </ul>	
5. DC and AC Single phase electrical machines	<ul style="list-style-type: none"> <li>❖ DC motors and generators</li> <li>❖ AC Single phase motors and generators</li> <li>❖ Single phase transformers</li> <li>❖ Application of AC and DC machines</li> <li>❖ Motor starter</li> <li>❖ DC Motor speed control</li> <li>❖ Motor cooling</li> </ul>	<ul style="list-style-type: none"> <li>❖ Assignments</li> <li>❖ Oral questioning</li> <li>❖ Supervised exercises</li> <li>❖ Written tests</li> <li>❖ Practical tests</li> </ul>

### Suggested Delivery Methods

- Group discussions
- Demonstration by trainer
- Exercises by trainee

### Recommended Resources

- Scientific Calculators
- Relevant reference materials
- Stationeries
- Electrical workshop
- Relevant practical materials
- Projector and screen
- Computers with internet connection
- Video camera

## **CORE UNITS OF LEARNING**

# PERFORM ELECTRICAL INSTALLATION

**UNIT CODE: EICC001**

## Unit Description

This unit specifies the competencies required to perform electrical installation work for single phase systems. It focuses on the application of health, safety and environmental standards, preparation of working drawings, Assemble tools, equipment, materials and drawing instruments, and Perform electrical installation

## Learning Outcomes

By the end of this unit, the trainee will be able to:

1. Apply health, safety and environmental standards
2. Assemble tools, equipment and materials
3. Prepare working drawings
4. Perform electrical installation

## Learning Outcomes, Content and Suggested Assessment Methods:

Learning Outcome	Content	Suggested Assessment Methods
1. Apply health, safety and environmental standards	<ul style="list-style-type: none"><li>❖ Causes of accidents and sources of danger e.g burns, cuts, electric shock, falling from heights, falling objects, noise, dust, chemicals</li><li>❖ Work injury benefits act (WIBA)</li><li>❖ PPEs; meaning, purpose, correct handling, use maintenance and storage.</li><li>❖ Classes of fire and fire fighting equipment</li><li>❖ First aid procedures; rescuing electric shock victim, methods of Resuscitation</li></ul>	<ul style="list-style-type: none"><li>❖ Written tests</li><li>❖ Oral questioning</li></ul>

<p>2. Assemble tools, equipment and materials</p>	<ul style="list-style-type: none"> <li>❖ Types, application, care, maintenance and storage of: <ul style="list-style-type: none"> <li><b>i. Tools</b> <ul style="list-style-type: none"> <li>• Cable strippers</li> <li>• Pliers</li> <li>• Screw drivers</li> <li>• Hammers</li> <li>• Chisels</li> <li>• Allen keys</li> <li>• Electrician knives</li> <li>• Crimping tools</li> <li>• Bending springs</li> <li>• Steel tapes</li> <li>• Draw wires</li> <li>• Hack saws</li> <li>• Drills</li> </ul> </li> <li><b>ii. Equipment</b> <ul style="list-style-type: none"> <li>• Multimeters</li> <li>• Earth tester</li> <li>• Phase sequence meter</li> </ul> </li> <li><b>iii. Materials</b> <ul style="list-style-type: none"> <li>• Cables</li> <li>• Fittings</li> <li>• Accessories</li> </ul> </li> </ul> </li> <li>❖ Inventory management</li> </ul>	<ul style="list-style-type: none"> <li>❖ Observation</li> <li>❖ Oral questioning</li> <li>❖ Practical tests</li> <li>❖ Written tests</li> </ul>
<p>3. Prepare working drawings</p>	<ul style="list-style-type: none"> <li>❖ Meaning of working drawings</li> <li>❖ Interpret electrical design drawings; <ul style="list-style-type: none"> <li>• Reading and Interpretation of architectural drawings</li> <li>• Relate architectural drawing to the work site</li> </ul> </li> <li>❖ Take actual measurements <ul style="list-style-type: none"> <li>• Liaise with other service providers</li> </ul> </li> <li>❖ Produce sketch drawing</li> <li>❖ Produce final working drawing</li> </ul>	<ul style="list-style-type: none"> <li>❖ Observation</li> <li>❖ Oral questioning</li> <li>❖ Practical tests</li> <li>❖ Written tests</li> </ul>

<p>4. Perform electrical installation</p>	<ul style="list-style-type: none"> <li>❖ Cables and cable joints</li> <li>❖ Consumer intake point</li> <li>❖ Wiring systems and accessories; Types and applications <ul style="list-style-type: none"> <li>• Pvc sheathed (surface wiring)</li> <li>• Trunking</li> <li>• Conduits</li> <li>• Cable ducts</li> <li>• Cable trays</li> </ul> </li> <li>❖ Installation of final circuits <ul style="list-style-type: none"> <li>• Lighting circuits; One way, two-way and intermediate</li> <li>• Power circuits; Radial circuits, ring circuits</li> <li>• Water heating circuits</li> <li>• Electric cooker circuits</li> <li>• Bell and alarm circuits</li> <li>• Electrical machines circuits- Single phase motors</li> </ul> </li> <li>❖ Earthing and protection <ul style="list-style-type: none"> <li>• Meaning of earthing</li> <li>• Terms in earthing</li> <li>• earthing systems</li> <li>• IEE regulations</li> <li>• Factors to consider in selecting an earthing system</li> <li>• Testing an earthing system</li> <li>• earthing improvement</li> </ul> </li> <li>❖ Relevant technical standards <ul style="list-style-type: none"> <li>• IEE regulations</li> <li>• British standards</li> <li>• Kenya bureau of standards (KEBS)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>❖ Observation</li> <li>❖ Oral questioning</li> <li>❖ Practical tests</li> <li>❖ Written tests</li> </ul>
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**Suggested Methods of Delivery**

- Projects
- 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

- Work injury benefits act (WIBA)
- Manufacturers' catalogues
- British standards
- KEBS standards

# TESTING OF ELECTRICAL INSTALLATION

UNIT CODE: EICR002

## 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

By the end of this unit, the trainee will be able to:

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

## Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Carry out physical inspection	<ul style="list-style-type: none"><li>❖ Inspection<ul style="list-style-type: none"><li>• Reasons for inspection</li><li>• Physical and visual check<ol style="list-style-type: none"><li>i. Firmness</li><li>ii. Loose connections</li><li>iii. Damaged accessories and fittings</li><li>iv. Colour coding</li><li>v. Cable management</li></ol></li></ul></li></ul>	<ul style="list-style-type: none"><li>❖ Observation</li><li>❖ Oral questioning</li></ul>
2. Identify the tests to be carried out.	<ul style="list-style-type: none"><li>❖ Testing<ul style="list-style-type: none"><li>• Meaning</li><li>• Purpose and reasons</li><li>• Types of tests<ol style="list-style-type: none"><li>i. Polarity</li><li>ii. Earth testing</li><li>iii. Insulation resistance</li><li>iv. Continuity test</li><li>v. Earth loop impedance test</li></ol></li><li>• Identification of test equipment</li><li>• Specification of test equipment</li><li>• Calibrate test equipment</li></ul></li></ul>	<ul style="list-style-type: none"><li>❖ Observation</li><li>❖ Oral questioning</li><li>❖ Written tests</li></ul>

Learning Outcome	Content	Suggested Assessment Methods
	<ul style="list-style-type: none"> <li>• Test equipment care, storage and maintenance</li> </ul>	
3. Perform identified tests	<ul style="list-style-type: none"> <li>❖ Reading and interpretation of appropriate manuals</li> <li>❖ Identification of test equipment e.g. <ul style="list-style-type: none"> <li>• Continuity tester (ohmmeter)</li> <li>• Insulation resistance tester</li> <li>• Earth loop impedance tester</li> <li>• Test lamp</li> </ul> </li> <li>❖ Procedure of conducting identified tests <ul style="list-style-type: none"> <li>• Polarity</li> <li>• Effectiveness of earthing</li> <li>• Insulation resistance</li> <li>• Ring circuit continuity</li> </ul> </li> <li>❖ Recording and verification of results against appropriate standards</li> <li>❖ Rectification of any anomalies</li> <li>❖ Safety precautions</li> </ul>	<ul style="list-style-type: none"> <li>❑ Observation</li> <li>❑ Oral questioning</li> <li>❑ Practical tests</li> <li>❑ Written tests</li> </ul>
4. Issue installation test results and wiring completion certificates	<ul style="list-style-type: none"> <li>❖ Installation test results certificate <ul style="list-style-type: none"> <li>• Meaning of terms</li> <li>• Importance</li> </ul> </li> <li>❖ Wiring certificate <ul style="list-style-type: none"> <li>• Meaning</li> <li>• Importance</li> <li>• Types</li> <li>• Issuing authority</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>❖ Written tests</li> <li>❖ Oral questioning</li> </ul>

### Suggested Methods of Delivery

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

### Recommended Resources

- Test instruments
  - i. Continuity tester (ohmmeter)
  - ii. Insulation resistance tester

- iii. Earth loop impedance tester
  - iv. Test lamp
- Materials and supplies
  - i. Stationery
  - ii. Wiring certificates

### **Reference materials**

- Manufacturers' manuals
- Relevant catalogues
- IEE regulations

# ELECTRICAL INSTALLATION BREAKDOWN MAINTENANCE

UNIT CODE: EICR003

## 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

By the end of this unit, the trainee will be able to:

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

## Learning Outcomes, Content and Suggested Assessment Methods:

Learning Outcome	Content	Suggested Assessment Methods
1. Identify installation failure	<ul style="list-style-type: none"><li>❖ Gathering information<ul style="list-style-type: none"><li>• Principle of operation</li><li>• Visual inspection</li><li>• Interview of users</li></ul></li><li>❖ Types of failures<ul style="list-style-type: none"><li>• Partial</li><li>• Total</li></ul></li><li>❖ Referring to as-built drawings and manuals</li></ul>	<ul style="list-style-type: none"><li>❖ Oral questioning</li><li>❖ Written tests</li></ul>
2. Troubleshoot cause of failure.	<ul style="list-style-type: none"><li>❖ Conducting fault diagnosis<ul style="list-style-type: none"><li>• Electrical faults<ol style="list-style-type: none"><li>i. Open circuit</li><li>ii. Short circuit</li><li>iii. Earth fault</li></ol></li><li>• Environmental faults</li><li>• Mechanical faults</li></ul></li><li>❖ Recording of installation failure results</li></ul> <p>Parameters</p> <ul style="list-style-type: none"><li>• Voltage</li><li>• Current</li><li>• Resistance</li></ul>	<ul style="list-style-type: none"><li>❖ Oral questioning</li><li>❖ Practical tests</li><li>❖ Written tests</li></ul>

3. Repair the installation	<ul style="list-style-type: none"> <li>❖ Identification of tools, equipment and materials for repair/replace</li> <li>❖ Specification of tools</li> <li>❖ Repair/Replace <ul style="list-style-type: none"> <li>• Power isolation</li> <li>• Conducting repair activities</li> <li>• Recording repair activities</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>❖ Observation</li> <li>❖ Oral questioning</li> <li>❖ Practical tests</li> <li>❖ Written tests</li> </ul>
4. Test the repaired system	<ul style="list-style-type: none"> <li>❖ Identification of test and test points <ul style="list-style-type: none"> <li>• Test parameters ; - Voltage, current, resistance</li> </ul> </li> <li>❖ Prepare and document maintenance report</li> </ul>	<ul style="list-style-type: none"> <li>❖ Observation</li> <li>❖ Oral questioning</li> <li>❖ Practical tests</li> <li>❖ Written tests</li> </ul>

### **Suggested Methods of Delivery**

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

### **Recommended Resources**

#### **Tools**

- Set of screw drivers
- Pliers
- Phase testers

#### **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