

**REPUBLIC OF KENYA**

**NATIONAL OCCUPATIONAL STANDARDS**

**FOR**

**ELECTRONICS ARTISAN**

**LEVEL 4**



TVET CDACC

P.O BOX 15745-00100

NAIROBI

First published 2019

© 2019, TVET CDACC

All rights reserved. No part of these Occupational Standards may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods without the prior written permission of the TVET CDACC, except in the case of brief quotations embodied in critical reviews and certain other non-commercial uses permitted by copyright law. For permission requests, write to the Council Secretary/CEO, at the address below:

**Council Secretary/CEO**

**TVET Curriculum Development, Assessment and Certification Council**

**P.O. Box 15745–00100 Nairobi, Kenya**

**Email:** [**info@tvetcdacc.go.ke**](mailto:info@tvetcdacc.go.ke)

**FOREWORD**

The provision of quality education and training is fundamental to the Government’s overall strategy for social economic development. Quality education and training will contribute to achievement of 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 in the formulation of the Policy Framework for Reforming Education and Training. A key feature of this policy is the radical change in the design and delivery of the TVET training. This policy document requires that training in TVET be competency based, Curriculum development be industry led, certification be based on demonstration of competence and mode of delivery allows for multiple entry and exit in TVET programmes.

These reforms demand that Industry takes a leading role in Curriculum development to ensure the Curriculum addresses its competence needs. It is against this background that these Occupational Standards was developed for the purpose of developing a competency-based Curriculum for electronic Technology level 4. These Occupational Standards will also be the basis for assessment of an individual for competence certification.

It is my conviction that these Occupational Standards 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**

The TVET Curriculum Development, Assessment and Certification Council (TVET CDACC), in conjunction with Electrical and electronic Sector Skills Advisory Committee (SSAC) have developed these Occupational Standards for an Electronics Artisan level 4. These standards will be the basis for development of a competency-based Curriculum for Electronics Technology level 4. These Standards will also be the basis for assessment of an individual for competence certification.

The Occupational Standards are designed and organized with clear performance criteria for each element of a unit of competency. These standards also outline the required knowledge and skills as well as evidence guide.

I am grateful to the Council Members, Council Secretariat, Electrical and electronic SSAC, expert workers and all those who participated in the development of these Occupational Standards.

**CHAIRPERSON, TVET CDACC**

**ACKNOWLEDGMENT**

These Occupational Standards were developed through combined effort of various stakeholders from private and public organizations. I am sincerely thankful to the management of these organizations for allowing their staff to participate in this course. I wish to acknowledge the invaluable contribution of industry players who provided inputs towards the development of these Standards.

I thank TVET Curriculum Development, Assessment and Certification Council (TVET CDACC) for providing guidance on the development of these Standards. My gratitude goes to the electronics Sector Skills Advisory Committee (SSAC) members for their contribution to the development of these Standards. I thank all the individuals and organizations who participated in the validation of these Standards.

I acknowledge all other institutions which in one way or another contributed to the development of these Standards.

**CHAIRPERSON ELECTRICAL AND ELECTRONICS SECTOR SKILLS ADVISORY COMMITTEE**

**TABLE OF CONTENT**

[FOREWORD iii](#_Toc68708715)

[PREFACE iv](#_Toc68708716)

[ACKNOWLEDGMENT v](#_Toc68708717)

[ABBREVIATIONS ANDACRONYMS vii](#_Toc68708718)

[KEY TO UNIT CODE viii](#_Toc68708719)

[OVERVIEW ix](#_Toc68708720)

[BASIC UNITS OF COMPETENCY 1](#_Toc68708721)

[DEMONSTRATE COMMUNICATION SKILLS 2](#_Toc68708722)

[DEMONSTRATE DIGITAL LITERACY 7](#_Toc68708723)

[DEMONSTRATE ENTREPRENEURIAL SKILLS 11](#_Toc68708724)

[DEMONSTRATE EMPLOYABILITY SKILLS 16](#_Toc68708725)

[DEMONSTRATE ENVIRONMENTAL LITERACY 21](#_Toc68708726)

[DEMONSTRATE OCUPATIONAL SAFETY AND HEALTH PRACTICES 25](#_Toc68708727)

[COMMON UNITS OF COMPETENCY 29](#_Toc68708728)

[DEMONSTRATE UNDERSTANDING OF ELECTRONICS 30](#_Toc68708729)

[APPLY ENGINEERING MATHEMATICS 32](#_Toc68708730)

[PERFORM WORKSHOP PRACTICES 38](#_Toc68708731)

[APPLY ELECTRICAL PRINCIPLES 42](#_Toc68708732)

[PREPARE AND INTERPRET TECHNICAL DRAWINGS 46](#_Toc68708733)

[CORE UNITS OF COMPETENCY 50](#_Toc68708734)

[PERFORM ELECTRICAL INSTALLATION 51](#_Toc68708735)

[INSTALL POWER SUPPLY SYSTEMS 57](#_Toc68708736)

[APPLY ELECTRICAL INSTRUMENTATION 62](#_Toc68708737)

[MAINTAIN ELECTRICAL AND ELECTRONIC EQUIPMENT AND APPLIANCES 65](#_Toc68708738)

**ABBREVIATIONS ANDACRONYMS**

A Control Version

BC Basic Competencies

CC Common Competencies

CDACC Curriculum Development, Assessment and Certification Council

CR Core Competencies

EE Electronics Engineering

EHS Environment, Health and Safety

ENG Engineering

ET Electronics Technician

IBMS Integrated Building Management System

IEE Institute of Electrical Engineers

KEBS Kenya Bureau of Standards

OS Occupational Standards

OSHA Occupational Safety and Health Act

PPE Personal Protective Equipment

TVET Technical and Vocational Education and Training

WIBA Work injury benefits Act

**KEY TO UNIT CODE**

ENG/OS/EA/BC/01/4/A

Industry or sector

Occupational Standards

Occupational area

Type of competency

Competency number

Competency level

Control Version

**OVERVIEW**

Electronic Artisan Level 4 qualification consists of competencies that a person must achieve to enable him/her to be certified as an Electronic Artisan

Electronic Artisan is a person who will carry out electrical and electronic installation and maintenance duties. This work demands that the Artisan designs, read and interpret electrical drawings so that he/she can install the electrical and electronic system according to the national and international standards. Thus, the units of competency for Electronic Artisan level 4 qualifications include the following basic, common and core competencies:

**BASIC COMPETENCIES**

|  |  |
| --- | --- |
| **Unit of Competency Code** | **Unit of Competency Title** |
| ENG/OS/EA/BC/01/4/A | Demonstrate Communication skills |
| ENG/OS/EA/BC/02/4/A | Demonstrate Digital Literacy |
| ENG/OS/EA/BC/03/4/A | Demonstrate Entrepreneurial skills |
| ENG/OS/EA/BC/04/4/A | Demonstrate Employability skills |
| ENG/OS/EA/BC/05/4/A | Demonstrate Environmental literacy |
| ENG/OS/EA/BC/06/4/A | Demonstrate Occupational safety and health practices |

**COMMON UNITS OF COMPETENCY**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| ENG/OS/EA/CC/01/4/A | Demonstrate understanding of Electronics |
| ENG/OS/EA/CC/02/4/A | Apply engineering mathematics |
| ENG/OS/EA/CC/03/4/A | Perform workshop practices |
| ENG/OS/EA/CC/04/4/A | Apply electrical principles |
| ENG/OS/EA/CC/05/4/A | Prepare and interpret technical drawings |

**CORE UNITS OF COMPETENCY**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| ENG/OS/EA/CR/01/4/A | Perform electrical installation |
| ENG/OS/EA/CR/02/4/A | Install power supply systems |
| ENG/OS/EA/CR/03/4/A | Apply electrical instrumentation |
| ENG/OS/EA/CR/04/4/A | Maintain Electrical and Electronic Equipment and Appliance |

**BASIC UNITS OF COMPETENCY**

## DEMONSTRATE COMMUNICATION SKILLS

**UNIT CODE:** ENG/OS/EA/BC/01/4/A

**UNIT DESCRIPTION**

This unit covers the competencies required demonstrate communication skills. It involvesobtaining and conveying workplace information, completing relevant work-related documents, communicating information about workplace processes, leading workplace discussion and communicating workplace issues.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms*** ***are elaborated in the Range*** |
| 1. Obtain and convey workplace information | 1. Specific and relevant information is accessed from ***appropriate sources*** based on standard procedures 2. Effective questioning, active listening and speaking skills are used to gather and convey information based on communication needs 3. Appropriate ***medium*** is used to transfer information and ideas in accordance with workplace guidelines 4. Appropriate non- verbal communication is used as per the communication needs 5. Appropriate lines of communicationwith supervisors and colleagues are identified and followed based on workplace requirements 6. Location and storage of information is undertaken according to workplace procedures    1. Personal interaction is carried out clearly and concisely according to workplace requirements |
| 1. Complete relevant work-related documents | * 1. Range of forms relating to conditions of employment are completed according to workplace procedures   2. Workplace data is recorded based on workplace requirements   3. Errors in recording information are identified and acted upon in accordance with workplace policies   4. Reporting requirements are completed according to organizational guidelines |
| 1. Communicate information about workplace processes | 1. Information sources are identified according to workplace procedures 2. ***Methods of communication*** are selected based on workplace guidelines 3. Multiple operations are communicated according to workplace structure 4. Work-related questions are asked and responded based on set protocols 5. Information is selected and organized according to workplace requirements 6. Verbal and written reporting is undertaken as per workplace requirements 7. Communication is maintained according to workplace standards |
| 1. Lead workplace discussions | 1. Response to workplace issues is sought and provided as per workplace protocol 2. Constructive contributions are made based on ***workplace discussions*** 3. Workplace objectives and action plan are communicated according to workplace requirements |
| 1. Identify and communicate issues arising in the workplace | 1. Issues and problems are identified as per workplace guidelines 2. Problems and issues in the workplace are organized according to workplace operations 3. Dialogue is initiated with appropriate personnel as per workplace structure 4. Problems and issues raised are communicated as per the workplace reporting procedures |

**RANGE**

This section provides work environment and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Methods of communication mayinclude but not limited to: | * Non-verbal gestures * Verbal * Face to face * Two-way radio * Speaking to groups * Using telephone * Written * Internet |
| 1. Workplace discussion may include but not limited to: | * Coordination meetings * Toolbox discussion * Peer-to-peer discussion |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Communication
* Active listening
* Interpretation
* Negotiation
* Writing

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Organization requirements for written and electronic communication methods
* Effective verbal communication methods
* Report writing
* Effective questioning techniques (clarifying and probing)
* Workplace etiquette

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   1. Dealt with a range of communication/information at one time 2. Made constructive contributions in workplace issues 3. Sought workplace issues effectively 4. Responded to workplace issues promptly 5. Presented information clearly and effectively in written form 6. Used appropriate sources of information 7. Asked appropriate questions 8. Provided accurate information |
| 1. Resource Implications | 1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place 3. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | 1. Third-party reports 2. Portfolio 3. Interview 4. Written tests 5. Observation 6. Oral questioning |
| 1. Context of Assessment | Competency may be assessed   1. On the job 2. Off the job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## DEMONSTRATE DIGITAL LITERACY

**UNIT CODE:** ENG/OS/EA/BC/02/4/A

**UNIT DESCRIPTION**

This unit covers the competencies required to demonstrate digital literacy in a working environment. It entails identifying computer software and hardware, applying security measures to data, hardware, software , applying computer software in solving task sand applying internet and email in communication at workplace.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms*** ***are elaborated in the Range*** |
| 1. Identify computer software and hardware | * 1. ***Appropriate computer software*** is identified according to manufacturer’s specification   2. ***Appropriate computer hardware*** is identified according to manufacturer’s specification |
| 1. Apply security measures to data, hardware, software | * 1. ***Data security and privacy are classified*** in accordance with the technological situation   2. ***Security and control measures*** are applied in accordance with laws governing protection of ICT   3. Computer threats and crimes are detected as per information security management guidelines.   4. Protection against computer crimes is undertaken in accordance with laws governing protection of ICT |
| 1. Apply computer software in solving tasks | * 1. Basic word processing concepts are applied in resolving workplace tasks   2. Word processing utilities are applied in accordance with workplace procedures   3. Data is manipulated on worksheet in accordance with office procedures |
| 1. Apply internet and email in communication at workplace | * 1. Electronic mail is applied in workplace communication in accordance with office procedures   2. Office internet functions are defined and executed in accordance with office procedures   3. Network configuration and uses are determined in accordance with office operations procedures |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Range** | **Variable** |
| 1. Appropriate computer software may include but not limited to: | * Operating system * MS office * Web browser * Media players |
| 1. Appropriate computer hardware may include but not limited to: | * Computer Case * Monitor * Keyboard * Mouse * Hard Disk Drive * Motherboard * Video Card |
| 1. Data security and privacy may include but not limited to: | * Confidentiality * Cloud computing * Confidentiality * Cyber terrorism * Integrity -but-curious data serving |
| 1. Security and control measures may include but not limited to: | * Countermeasures and risk reduction * Cyber threat issues * Risk management |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Analytical
* Interpretation
* Typing
* Communication
* Computing

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Input and output devices
* Central processing Unit (CPU)
* Peripherals
* Storage Media
* Software concept
* Types of concept
* Function of computer software
* Data security and privacy
* Security threats and control measures
* Computer crimes
* Detection and protection of computer crimes
* Laws governing protection of ICT
* Word processing;
* Functions and concepts of word processing.
* Documents and tables creation and manipulations
* Mail merging
* Word processing utilities
* Spread sheet;
* Meaning, formulae, function and charts, uses, layout, data manipulation and application to cell
* Networking and Internet;
* Meaning, functions and uses of networking and internet.
* Electronic mail and world wide web
* Emerging trends and issues in ICT;
* Identify and apply emerging trends and issues in ICT
* Challenges posed by emerging trends and issues

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Identified input, output, CPU and storage media devices of computers in accordance to computer specification   2. Identified concepts, types and functions of computer software according to operation manual   3. Identified and controlled security threats   4. Detected and protected computer crimes   5. Applied word processing in office tasks   6. Prepared work sheet and applied data to the cells in accordance to workplace procedures   7. Used Electronic Mail for office communication as per workplace procedure   8. Applied internet and World Wide Web for office tasks in accordance with office procedures   9. Applied laws governing protection of ICT |
| 1. Resource Implications | * 1. Access to relevant workplace where assessment can take place   2. Appropriately simulated environment where assessment can take place   3. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Written tests   2. Practical assignment   3. Interview   4. Oral Questioning   5. Observation |
| 1. Context of Assessment | Competency may be assessed   1. On the job 2. Off the job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## DEMONSTRATE ENTREPRENEURIAL SKILLS

**UNIT CODE:** ENG/OS/EA/BC/03/4/A

**UNIT DESCRIPTION**

This unit covers the competencies required demonstrate entrepreneurial skills. It involvescreating and maintaining small scale business, establishing small scale business customer base, managing small scale business and growing/ expanding small scale business.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the **key outcomes** which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Create and maintain small scale business | 1. Generation and evaluation of business ideas is undertaken in accordance with the existing procedure 2. Competencies are matched with business opportunities in accordance with business practices. 3. Procedure for starting a small business is identified as per the legal requirements 4. SWOT/ PESTEL analysis and or industrial survey is carried out according to office procedures 5. ***Business operations*** are monitored and controlled following established procedures. 6. Quality assurance measures are implemented in accordance with the business practices. 7. Good relations are maintained with staff/workers as per the workplace policies. 8. Policies and procedures on occupational safety and health and environmental concerns are constantly observed as per the workplace policies |
| 1. Establish small scale business customer base | 1. Good customer relations are maintained in accordance with office procedures 2. New customers and markets are identified, explored and reached out to according to the marketing plan 3. Promotions/Incentives are offered to loyal customers in accordance with office procedures 4. Additional products and services are evaluated and tried in accordance with marketing strategy 5. Customer record is maintained in accordance with office procedures |
| 1. Manage small scale business | 1. Enterprise is built up and sustained in line with judicious control of cash flows. 2. Profitability of enterprise is ensured as per the internal controls. 3. Unnecessary or lower-priority expenses and purchases are avoided as per the marketing strategy 4. Basic cost-benefit analysis are undertaken in accordance with office procedures 5. Basic financial management are undertaken in accordance with office procedures 6. Basic financial accounting in undertaken in accordance with office procedures 7. Business ***internal controls*** are implemented in accordance with office procedure 8. Setting business priorities and strategies is carried out according to office procedures 9. Preparation and interpretation of basic financial statements is undertaken in accordance with set procedures 10. Preparation of business plansfor small business is undertaken in accordance with ***business strategy*** 11. Business Social Responsibility is maintained in accordance with Standard Operations Procedures (SOP) |
| 1. Grow/ expand small scale business | 1. Prepared business growth strategy for small sale business in accordance with office procedures 2. Incorporated technology in small scale business growth in accordance with technological trends 3. Emerging issues and trends are considered in accordance with business growth strategy 4. Built audience interest in product/service according to growth strategy 5. Boosted cooperate communication according to business ***communication strategy*** |

**RANGE**

This section provides work environment and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Business operations may include but not limited to: | * Purchasing * Accounting/administrative * Work production/operations/sales * Marketing |
| 1. Internal control may include but not limited to: | * Accounting systems * Financial statements/reports * Cash management * Human resource management |
| 1. Business Strategy may include but not limited to: | * Management of wastages * Environmental Conservation |
| 1. Communication strategy may include but not limited to: | * Blue print of exchange of information * Technology and exchange of information |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Marketing
* Advertising
* Basic bookkeeping
* Accounting
* Communication

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Generation and evaluation of business ideas
* Legal requirements for starting a small business
* SWOT/ PESTEL analysis
* Occupational Safety and Health
* Public relations concepts
* Business plan
* Business financing
* Marketing strategies
* Business management and control
* Production/ operation process
* Product promotion strategies
* Market and feasibility studies
* Business ethics
* Building customer relations
* Business models and strategies
* Types and categories of businesses
* Business internal controls
* Relevant national and local legislation and regulations
* Basic quality control and assurance concepts
* Building relations with customer and employees
* Building competitive advantage of the enterprise
* Business growth strategies

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |  |
| --- | --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   |  | | --- | | 1. Demonstrated entrepreneurial skills 2. Demonstrate competencies to create a small-scale business 3. Demonstrated ability to conceptualize and plan a micro/small business 4. Grew customer base for the small-scale business 5. Demonstrated ability to manage/operate a micro/small-scale business 6. Demonstrated competencies to grow a micro/small-scale business | |
| 1. Resource Implications | |  | | --- | | The following resources should be provided: |  1. Assessment location 2. Case studies on micro/small-scale enterprises 3. Assessment materials |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   |  |  | | --- | --- | | 1. Written tests 2. Observation 3. Oral questioning 4. Portfolio 5. Projects |  | |
| 1. Context of Assessment | Competency may be assessed   1. On the job 2. Off the job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## DEMONSTRATE EMPLOYABILITY SKILLS

**UNIT CODE:** ENG/OS/EA/BC/04/4/A

**UNIT DESCRIPTON**

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.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Conduct self-management | 1. Personal vision, mission and goals are formulated based on potential and in relation to organization objectives 2. Emotional intelligence is demonstrated as per workplace requirements. 3. Individual performance is evaluated and monitored according to the agreed targets. 4. Assertiveness is developed and maintained based on the requirements of the job. 5. Accountability and responsibility for own actions are demonstrated based on workplace instructions. 6. Self-esteem and a positive self-image are developed and maintained based on values. 7. Time management, attendance and punctuality are observed as per the organization policy. 8. Goals are managed as per the organization’s objective 9. Self-strengths and weaknesses are identified based on personal objectives |
| 1. Demonstrate critical safe work habits | 1. Stress is managed in accordance with workplace policy. 2. Punctuality and time consciousness is demonstrated in line with workplace policy. 3. Personal objectives are integrated with organization goals based on organization’s strategic plan. 4. ***Resources*** are utilized in accordance with workplace policy. 5. Work priorities are set in accordance to workplace goals and objectives. 6. Leisure time is recognized and utilized in line with personal objectives. 7. ***Drugs and substances of abuse*** are identified and avoided based on workplace policy. 8. HIV and AIDS prevention awareness is demonstrated in line with workplace policy. 9. Safety consciousness is demonstrated in the workplace based on organization safety policy. 10. ***Emerging issues*** are identified and dealt with in accordance with organization policy. |
| 1. Demonstrate workplace learning | * 1. Learning opportunities are sought and managed based on job requirement and organization policy.   2. Improvement in performance is demonstrated based on courses attended.   3. Application of learning is demonstrated in both technical and non-technical aspects based on requirements of the job   4. Time and effort is invested in learning new skills based on job requirements   5. Initiative is taken to create more effective and efficient processes and procedures in line with workplace policy.   6. New systems are developed and maintained in accordance with the requirements of the job.   7. Awareness of personal role in workplace ***innovation*** is demonstrated based on requirements of the job. |
| 1. Demonstrate workplace ethics | 1. Policies and guidelines are observed as per the workplace requirements 2. Self-worth and professionalism is exercised in line with personal goals and organizational policies 3. Code of conduct is observed as per the workplace requirements 4. Integrity is demonstrated as per legal requirement |

**RANGE**

This section provides work environment and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

|  |  |
| --- | --- |
| **Range** | **Variable** |
| 1. Personal objectives may include but not limited to: | * Long term * Short term * Broad * Specific |
| 1. Feedback may include but not limited to: | * Verbal * Written * Informal * Formal |
| 1. Team may include but not limited to: | * Small work group * Staff in a section/department * Inter-agency group |
| 1. Drug and substance abuse may include but not limited to: | * Alcohol * Tobacco * Miraa * Over-the-counter drugs * Cocaine * Bhang * Glue |
| 1. Emerging issues may include but not limited to: | * Terrorism * Social media * National cohesion * Open offices |
| 1. Range of media for learning may include but not limited to: | * Mentoring * peer support and networking * IT and courses |
| 1. Innovation may include but not limited to: | * New ideas * Original ideas * Different ideas * Methods/procedures * Processes * New tools |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Communication
* Interpersonal
* Critical thinking
* Observation
* Organizing
* Record keeping
* Problem solving
* Decision Making
* Resource utilization

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Work values and ethics
* Company policies
* Company operations, procedures and standards
* Occupational Health and safety procedures
* Fundamental rights at work
* Personal hygiene practices
* Workplace communication
* Concept of time
* Time management
* Decision making
* Types of resources
* Work planning
* Record keeping
* Workplace problems and how to deal with them
* Assertiveness
* Team work
* HIV and AIDS
* Drug and substance abuse
* Safe work habits
* Professional growth and development
* Technology in the workplace
* Emerging issues
  + Social media
  + Terrorism
  + National cohesion

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   * 1. Conducted self-management   2. Demonstrated critical safe work habits   3. Demonstrated workplace learning   4. Demonstrated workplace ethics |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Oral questioning 2. Portfolio of evidence 3. Third Party Reports 4. Written tests |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## DEMONSTRATE ENVIRONMENTAL LITERACY

**UNIT CODE:** ENG/OS/EA/BC/05/4/A

**UNIT DESCRIPTION**

This unit specifies the competencies required to demonstrate environmental literacy. It involves controlling environmental hazard, controlling environmental pollution, demonstrating sustainable resource use and evaluating current practices in relation to resource usage.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms*** ***are elaborated in the Range*** |
| 1. Control environmental hazard | * 1. Storage methods for environmentally hazardous materials are followed according to environmental regulations and OSHS.   2. Disposal methods of hazardous wastes are followed according to environmental regulations and OSHS.   3. ***PPE*** is used according to OSHS. |
| 1. Control environmental pollution | * 1. ***Environmental pollution*** ***control measures*** are compiled following standard protocol.   2. Procedures for solid waste management are observed according Environmental Management and Coordination Act 1999   3. Methods for minimizing noise pollution complied following environmental regulations. |
| 1. Demonstrate sustainable use of resource s | * 1. Methods for minimizing wastage are complied with.   2. ***Waste management procedures*** are employed following principles of 3Rs (Reduce, Reuse, Recycle)   3. Methods for economizing or reducing resource consumption are practiced. |
| 1. Evaluate current practices in relation to resource usage | * 1. Information on resource efficiency ***systems and procedures*** are collected and provided as per work groups/sector   2. ***Current resource usage*** is measured and recorded as per work group/sector   3. Current purchasing strategies are analyzed and recorded according to industry procedures.   4. Current work processes to access information and data is analyzed following enterprise protocol. |
| 1. Identify environmental legislations/conventions for environmental concerns | 1. Environmental legislations/conventions and local ordinances are identified according to the different environmental aspects/impact 2. Industrial standard/environmental practices are described according to the different environmental concerns |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. PPE may include but are not limited to: | * Masks * Gloves * Goggles * Safety hat * Overall * Hearing protector * Safety boots |
| 1. Environmental pollution control measures may include but are not limited to: | * Methods for minimizing or stopping spread and ingestion of airborne particles * Methods for minimizing or stopping spread and inhaling gases and fumes * Methods for minimizing or stopping spread and ingestion of liquid wastes |
| 1. Waste management procedures may include but are not limited to: | * Sorting * Storing of items * Recycling of items * Disposal of items * Handling * Transport |
| 1. Current resources usage may include but are not limited to: | * Electric * Water * Fuel * Telecommunications * Supplies * Materials |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Measuring
* Recording
* Analytical
* Monitoring
* Writing
* Communication

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Storage methods of environmentally hazardous materials
* Disposal methods of hazardous wastes
* Usage of PPE Environmental regulations
* OSHS
* Types of pollution
* Environmental pollution control measures
* Different solid wastes
* Solid waste management
* Different noise pollution
* Methods of minimizing noise pollution
* Solid Waste Act
* Methods of minimizing wastage
* Waste management procedures
* Economizing of resource consumption
* Principle of 3Rs
* Types of resources
* Techniques in measuring current usage of resources
* Calculating current usage of resources
* Types of workplace environmental hazards
* Environmental regulations
* Environmental regulations applying to the enterprise.
* Procedures for assessing compliance with environmental regulations.
* 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 current work processes to access information and data Analysis of data and information

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   1. Controlled environmental hazards 2. Controlled environmental pollution 3. Demonstrated sustainable resource use 4. Evaluated current practices in relation to resource usage |
| 1. Resource Implications | The following resources should be provided:   * 1. Workplace with storage facilities   2. Tools, materials and equipment relevant to the tasks (e.g. cleaning tools, cleaning materials, trash bags, etc.)   3. PPEs   4. Manuals and references   5. Legislation, policies, procedures, protocols and local ordinances relating to environmental protection   6. Case studies/scenarios relating to environmental Protection |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Observation 2. Oral questioning 3. Written tests 4. Third party reports 5. Portfolio |
| 1. Context of Assessment | Competency may be assessed:   1. On the job 2. Off the job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## DEMONSTRATE OCUPATIONAL SAFETY AND HEALTH PRACTICES

**UNIT CODE:** ENG/OS/EA/BC/06/4/A

**UNIT DESCRIPTION**

This unit specifies the competencies required to practice safety and health and comply with OSH requirements relevant to work. It involves observing workplace procedures for hazards and risk prevention and participating in arrangements for workplace safety and health maintenance.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms*** ***are elaborated in the Range*** |
| 1. Adhere to workplace procedures for hazards and risk prevention | 1. Arrangement of work area and items in accordance with workplace procedures requirements 2. Work standards and procedures are followed based on instructions 3. ***Prevention and control measures*** are applied based on instructions |
| 1. Participate in arrangements for workplace safety and health maintenance | 1. Orientations on ***OSH requirements and regulations*** is undertaken in line with policy. 2. Feedback on occupational health and safety are provided as per workplace instructions. 3. Workplace procedures for reporting hazards, incidents, injuries and sickness are adhered to as per workplace policy. 4. ***OSH-related training needs*** are identified and proposed as per workplace policy. |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Prevention and control measures may include but are not limited to: | * Eliminate the hazard * Isolate the hazard * Substitute the hazard with a safer alternative * Use administrative controls to reduce the risk * Use engineering controls to reduce the risk * Use personal protective equipment * Safety, Health and Work Environment Evaluation * Periodic and/or special medical examinations of workers |
| 1. Safety gears /PPE (Personal Protective Equipment’s) may include but are not limited to: | * 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 |
| 1. Incidents and emergencies may include but are not limited to: | * Chemical spills * Equipment/vehicle accidents * Explosion * Fire * Gas leak * Injury to personnel * Structural collapse * Toxic and/or flammable vapors emission. |
| 1. OSH requirements / regulations may include but are not limited to: | * Building code * Permit to Operate |
| 1. OSH-related trainings may include but are not limited to: | * Safety Orientations relevant to tasks * Safe and Correct Operation of Tools and Equipment * Health Orientations/trainings * Prevention and Control of OSH Hazards in the workplace * Chemical Handling * Safety Trainings * Prevention and Control of Work-related Injuries and Illness * Basic First-aid Trainings * Emergency Response Trainings * Trainings on use of fire-extinguisher |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Communication
* Knowledge management
* Collaborating
* Interpersonal
* Troubleshooting
* Critical thinking
* Observation

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* General OSH principles and legislations
* Principles of good housekeeping (5S)
* Company/workplace policies/ guidelines
* Standards and safety requirements of work process and procedures
* Standard Workplace emergency plan and procedures
* Safety and health requirements of tasks
* Workplace guidelines on providing feedback on OSH and security concerns
* OSH regulations
* Hazard control procedures
* OSH trainings relevant to work

**EVIDENCE GUIDE**

|  |  |
| --- | --- |
| 1. This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range. Critical Aspects of Competency | Assessment requires evidence that the candidate:   1. Arranged work area and items in accordance with 2. workplace procedures requirements 3. Followed work standards and procedures based on instructions 4. Applied ***Prevention and control measures*** based on instructions 5. Undertook orientations on ***OSH requirements and regulations*** in line with policy. 6. Provided feedback on occupational health and safety as per workplace instructions. 7. Adhered to workplace procedures for reporting hazards, incidents, injuries and sickness to as per workplace policy. 8. Identified and proposed ***OSH-related training needs*** as per workplace policy. |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Oral questioning 2. Portfolio of evidence 3. Third Party Reports 4. Written tests |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# COMMON UNITS OF COMPETENCY

## DEMONSTRATE UNDERSTANDING OF ELECTRONICS

**UNIT CODE:** ENG/OS/EA/CC/01/4/A

**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.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements  ***(Bold and italicised terms are elaborated in the Range)*** |
| --- | --- |
| * 1. Apply semiconductor theory | * 1. Types of ***materials*** are established in line with semiconductor theory   2. Semiconductor materials are identified as per their electrical conductivity properties |
| * 1. Apply semiconductor diodes | * 1. Types of diodes are identified as per their functionality   2. ***Diodes*** characteristics are determined as per their properties   3. Forward and reverse bias characteristics are established as per the properties of the semiconductor material |
| 1. Demonstrate understanding of transistors | * 1. ***Transistors*** are identified as per their characteristics   2. NPN and PNP are determined as per their operation   3. P and N channels are identified as per their operation   4. ***Biasing*** and determination of gain of transistors is performed as per their standard operating procedure   5. Transistor configuration is performed as per their application |

**RANGE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required knowledge and understanding and range.

| **Variable** | **Range** |
| --- | --- |
| 1.Materials may include but is not limited to: | * Insulators * Conductors * Semiconductors |
| 1. Diodes may include but is not limited to: | * Photo diodes * Laser * Zener diodes * Light emitting diode * Schottky diodes |
| 1. Transistors may include but is not limited to: | * BJTs * FETs |
| 1. Biasing may include but is not limited to: | * Forward bias * Reverse bias |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

***The individual needs to demonstrate knowledge and understanding of:***

* The manufacturer's warranty requirements relating to electronic materials
* The legal and statutory requirements relating to Electronics
* workplace procedures relevant to:
* Health and safety;
* The environment (including waste disposal);
* Appropriate personal and protective equipment;
* Workplace procedures for:
  + - Appropriate use of tools and equipment
    - Electronics operations
    - Reporting of technical challenges
* The importance of documenting Electronics operations manuals
* The importance of working within agreed timelines and sharing progress reports.
* The relationship between time and costs.
* The importance of reporting anticipated delays to relevant parties promptly.
* How to find, interpret and use sources of technical information for project activities
* The importance of using the correct sources of technical information.

**FOUNDATION SKILLS**

The individual needs to demonstrate the following foundation skills:

* Amplifier construction
* Communications (verbal and written);
* Proficient in ICT;
* Time management;
* Analytical
* Problem solving;
* Planning;
* Decision making;
* First aid;
* Electronics biasing

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required knowledge and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | **Assessment requires evidence that the candidate:**   * 1. Identified different semiconductor material   2. Demonstrated understanding in biasing of semiconductor materials   3. Identified special semiconductor devices   4. Performed forward and reverse biasing of semiconductor materials   5. Identified different types of transistors   6. Demonstrated understanding of rectification. |
| 1. Resource Implications | The following resources must be provided:   * 1. Stationeries   2. Reference materials   3. Practical materials   4. Measuring instruments   5. Tools   Resources the same as that of workplace are advised to be applied |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Oral test   2. Written test   3. Observation   4. Practical demonstration |
| 1. Context of Assessment | Competency may be assessed   1. On job 2. Off job 3. During Industrial Attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## 

## APPLY ENGINEERING MATHEMATICS

**UNIT CODE:** ENG/OS/EA/CC/02/4

**UNIT DESCRIPTION:**

This unit describes the competencies required by an Electronic Artisan in order to apply algebra, trigonometry and hyperbolic function, complex numbers, coordinate geometry, carry out binomial expansion, carry out mensuration, calculus, statistics, vector and matrix.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range.*** |
| --- | --- |
| * 1. Apply Algebra | * 1. Calculations involving Indices are performed as per the concept   2. Calculations involving Logarithms are performed as per the concept   3. Scientific calculator is used in solving mathematical problems in line with manufacturer’s manual   4. Simultaneous equations are performed as per the rules   5. Quadratic equations are calculated as per the concept |
| * 1. Apply Trigonometry and hyperbolic functions | 2.1 Trigonometric identities are identified as per half angle formula  2.2 Factor formula is identified basing on trigonometric functions  2.3 Trigonometric functions are identified as per standard operating procedure  2.4 Calculations are performed in line with trigonometric rules  2.5 Parametric equations are developed basing on standard operating procedure  2.6 Relative are absolute measures are performed in line with standard operating procedure  2.7 Hyperbolic functions are identified as per standard operating procedure  2.8 Properties of hyperbolic functions are identified basing on established formula  2.9 Evaluation of hyperbolic functions and identities is performed in accordance to established standards  2.10 Hyperbolic equations are developed basing on Osborne’s rule  2.11 Inverse functions of hyperbolic functions are identified in line with standard operating procedures  2.12 Graphs of inverse functions are developed in accordance to established procedures |
| * 1. Apply complex numbers | 3.1 Complex numbers are represented using Argand diagrams  3.2 Operations involving complex numbers are performed  3.3 Calculations involving complex numbers are performed using De Moivre’s theorem |
| * 1. Apply Coordinate Geometry | 4.1 Polar equations are calculated using coordinate geometry  4.2Graphs of given polar equations are drawn using the Cartesian plane   * 1. Normal and tangents are determined using coordinate geometry |
| * 1. 5. 5.Carry out Binomial Expansion | 5.0 Roots of numbers are determined using binomial theorem  5.1 Errors of small changes are determined using binomial theorem |
| * 1. Carry out Mensuration | * 1. Perimeter and areas of regular figures are obtained based on established formulas   2. Volume and Surface area of solids are obtained as per established formulas   3. Area of irregular figures are obtained based on standard operating procedure   4. Volumes of irregular figures are obtained in accordance to Pappus theorem |
| 7. Apply Calculus | * 1. Differentiations of functions is performed as per established procedures   2. Differentiation of trigonometric functions are performed using as per standard operating procedure   3. Differentiation of hyperbolic functions are performed using as per standard operating procedure   4. Rate of change and small change are determined using Differentiation.   5. Calculation involving stationery points of functions of two variables are performed using differentiation.   6. Integrals of algebraic functions are determined using integration   7. Integration of trigonometric functions are performed using as per standard operating procedure   8. Integration of hyperbolic functions are performed using as per standard operating procedure |
| 1. Apply Statistics | * 1. Identification, Collection and Organization of data is performed   2. Interpretation, analysis and presentation of data in appropriate format is performed   3. Mean, median ,mode and Standard deviation are obtained from given data |
| 1. Apply Vector | * 1. Vectors and scalar quantities are obtained in two dimensions   2. ***Operations*** on vectors are performed   3. Position of vectors is obtained   4. Resolution of vectors is done   5. Gradient, Divergence and curl are determined   6. Dot and cross products are determined |
| 1. Apply Matrix | * 1. Determinant and inverse of 2x2 matrix are obtained   2. Solutions of simultaneous equations are obtained   3. Calculation involving Eigen values and Eigen vectors are performed |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Operations may include but not limited to: | * + Addition   + Subtraction |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Applying fundamental operations (addition, subtraction, division, multiplication)
* Using and applying mathematical formulas
* Logical thinking
* Problem solving
* Drawing graphs
* Using different measuring tools

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Fundamental operations (addition, subtraction, division, multiplication)
* Calculating area and volume
* Types and purpose of measuring instruments
* Units of measurement and abbreviations
* Rounding techniques
* Types of fractions
* Types of tables and graphs
* Presentation of data in tables and graphs
* Vector operations
* Matrix operations

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   1. Applied complex algebraic equations 2. Carried out mensuration 3. Applied Vector theory 4. Applied Matrix |
| 1. Resource Implications | The following resources should be provided:   * 1. Access to relevant workplace or appropriately simulated environment where assessment can take place   2. Measuring equipment   3. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Direct Observation 2. Demonstration with Oral Questioning 3. Written tests |
| 1. Context of Assessment | Competency may be assessed   1. On job 2. Off job 3. During Industrial Attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## PERFORM WORKSHOP PRACTICES

**UNIT CODE:** ENG/OS/EA/CC/03/4/A

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicised terms are elaborated in the Range)*** |
| --- | --- |
| 1. Apply workshop safety | 1. Proper use of PPE is adhered to as per standard operating procedure 2. Workshop rules are followed as per standard operating procedure 3. Proper use of safety equipments are followed as per the manufacturers recommendations 4. First Aid procedures are adhered to |
| 1. Use workshop tools, Instruments and equipments | * 1. ***Workshop tools***, Instruments and equipments are Identified   2. Tools, Instruments and equipments are used as per the manufactures manuals   3. Calibration of workshop instruments are performed as per the standard operating procedure   4. Proper handling of workshop tools, Instruments and equipments should be followed   5. Care and Maintenance of workshop tools, Instruments and equipments should be adhered too |
| 1. Prepare workshop tools and instruments for an Electrical installation practical e.g. | * 1. List of required tools and instruments are prepared   2. Issuing of required tools and instruments is performed   3. Confirmation of the issued tools and instruments is performed   4. Functioning of the issued tools and instruments is checked in line with the standard operating procedure   5. Sharpening of the cutting tools is performed |
| 1. Prepare workshop for an Electrical practical | * 1. Practical working section is arranged as per the number of practicals to be carried out.   2. Power supply availability in every practical section is confirmed as per the practical to be carried out   3. Tools and materials required are supplied as per the practical to be carried out. |
| 1. Store Electrical tools and materials after practicals | * 1. Tools are checked against the issuing list after practicals   2. Tools are stored out as per their standard operating procedure   3. Tools are cleaned as per the workshop standard operating procedure   4. Waste materials are disposed as per the EHS   5. Tools are stored in their respective sections as per the workshop procedures |
| 1. Troubleshoot and repair/replace workshop tools and equipment | * 1. Faulty tools are identified as per their expected functioning   2. Faulty component are diagnosed as per the fault diagnosis procedures   3. Repair/Replace faulty components as per the expected functioning   4. Repaired/Replaced tool are tested as per the expected functioning. |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| Workshop tools include but not limited to: | * + Pliers   + Hacksaws   + Hammer   + Spirit levels   + Phase Tester   + Side cutters |
| Manual include but not limited to: | * Operational * Installation * Commissioning * Technical specification /data sheet |
| Parameters include but not limited to: | * + Light intensity   + Sound   + Speed   + Efficiency   + Temperature   + Electrical quantities e.g. Voltage, current and resistance levels   + Expected output |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

***The individual needs to demonstrate knowledge and understanding of:***

* The manufacturer's manual about the operation of various workshop tools and instruments
* The legal and statutory requirements relating to electrical Workshop operation activities.
* workplace procedures relevant to:
* health and safety;
* the environment (including waste disposal);
* appropriate personal and protective equipment;
* appropriate use of service manuals
* Workplace procedures for:
  + - Fault identification and diagnosis
    - Appropriate use of tools and equipment;
    - Repairing, modifying or replacing defective parts or components.
    - Reporting of technical challenges
* The importance of documenting workshop practical activities and information.
* The importance of working within agreed timelines and sharing progress reports.
* The importance of reporting anticipated delays to relevant parties promptly.
* How to find, interpret and use sources of technical information for workshop practical activities
* The importance of using the correct sources of technical information.
* The purpose of and how to use identification codes.

**FOUNDATION SKILLS**

The individual needs to demonstrate the following foundation skills:

* Communications (verbal and written);
* Proficient in ICT;
* Time management;
* Analytical
* Faults troubleshooting;
* Problem solving;
* Planning;
* Decision making;
* First aid;
* Report writing

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required knowledge and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | **Assessment requires evidence that the candidate:**   * 1. Adhered to the proper use of PPE   2. Observed the workshop rules   3. Performed the First Aid procedures in the workshop   4. Observed workshop procedures in the storage of tools   5. Safely used testing equipment and tools   6. Observed EHS in the waste disposal   7. Properly demonstrated care and maintenance of workshop tools   8. Obtained, recorded and interpreted test results   9. Identified faulty tools and instruments   10. Repaired/Replaced faulty tools |
| 1. Resource Implications | ***The following resources must be provided:***   * 1. Electrical installation tool kit   2. Testing equipment   3. Measuring equipment   4. First Aid kit   Resources the same as that of workplace are advised to be applied |
| 1. Methods of Assessment | **Competency may be assessed through:**   * 1. Oral test   2. Observation   3. Practical demonstration |
| 1. Context of Assessment | Competency may be assessed   1. On job 2. Off job 3. During Industrial Attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY ELECTRICAL PRINCIPLES

**UNIT CODE:** ENG/OS/EA/CC/04/4/A

**UNIT DESCRIPTION**

This unit describes the competencies required by a technician in order to apply a wide range of Electrical principles in their work: Competencies include; use the concept of basic Electrical quantities, concepts of D.C and A.C circuits in electrical installation, use of electrical machine, use of earthing in Electrical installations and apply capacitance and inductance

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range.*** |
| --- | --- |
| 1. Use the concept of basic Electrical quantities | * 1. Basic ***SI unit***s in Electrical are identified as established standards   2. ***Quantitie***s of Charge, force, work and power are identified as per established standards   3. Perform calculations involving electrical quantities i.e Current, Resistance and voltage as per established standards |
| 1. Use the concepts of D.C and A.C circuits in electrical installation | * 1. Theory of conductors and insulators is determined as per established procedures   2. Ohm’s law is performed as per established procedures   3. Calculations involving resistor connection is performed as per established procedures   4. Color coding for fixed resistors is performed as per established standards   5. Calculations involving parallel and series circuits are performed as per established standards   6. Calculations involving R-L-C circuits are performed as per established standards   7. Calculations involving DC and AC circuits. Network theorems are performed. E.g. Kirchoff’s laws,   8. Conversion of AC to DC and DC to AC are performed as per established standards   9. Parallel resonance and Q-factor are determined as per established standards   10. Power factor improvement is performed as per established standards |
| 1. Use of single phase electrical machine | * 1. Types of single-phase electrical machines are identified as per established standards   2. Calculations involving single phase AC and DC Motors are performed per established standards   3. Types of single phase transformers are identified as per established standards   4. Calculations involving single AC and DC transformers are performed as per established standards   5. Types of single phase generators are identified as per established standards   6. Motor starting methods are identified as per established procedure   7. DC motor speed control is established as per standard operating procedures |
| 1. Use of earthing in Electrical installations | * 1. Earthing types are identified as per established standards   2. Earthing systems are identified as per established procedures   3. Tests to determine the earthing system are performed as per established standards   4. Test on an earthing system is performed in line with the IEE regulations |
| 1. Apply capacitance and inductance | * 1. Sources of Electrostatic fields are identified as established procedures   2. Dielectric materials are identified as per the established standards   3. Calculations involving capacitor parameters are performed as per established standards   4. Types of capacitors are identified as per established standards   5. Concept of charge and electrostatic field is established as per established standards   6. Calculations involving capacitors are performed as per established standards   7. Concept of magnetic circuits is identified as per established procedure   8. Parameters   9. Calculations involving inductors are performed as per established procedures |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. SI unit may include but not limited to: | * + Power – Watts (W)   + Current – Amperes (A)   + Resistance – Ohms(Ω)   + Voltage – Volts (V) |
| 1. Quantities may include but not limited to: | * + Charge   + Force   + Work   + Power |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Apply basic Electrical formulas
* Use of basic Electrical instruments
* Perform various unit conversions of Electrical quantities
* Electrical earthing
* Lightening arrestors
* logical thinking
* problem solving
* drawing graphs
* Using different measuring tools

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Electrical power calculations
* Various laws in Electrical engineering
* Electrical formulas
* SI units of various electrical parameters
* Earthing testing
* Lightening arrestor testing
* Selecting the correct type of electrical machines for various uses
* Types and purpose of measuring instruments
* Units of measurement and abbreviations

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   * 1. Applied the correct SI units of Electrical quantities   2. Stated, Calculate and relates the quantities in Ohm’s law   3. Identified the components of an earthing system   4. Stated and apply various laws in Electrical system   5. Differentiated between AC and DC circuits.   6. Applied correct formulas in the calculation of AC and DC machines   7. Identified types of lightening arrestors and their applications |
| 1. Resource Implications | The following resources should be provided:   * 1. Access to relevant workplace or appropriately simulated environment where assessment can take place   2. Measuring equipment   3. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Direct Observation   2. Oral Questioning   3. Written tests |
| 1. Context of Assessment | Competency may be assessed  On job  Off job  During Industrial Attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## PREPARE AND INTERPRET TECHNICAL DRAWINGS

**UNIT CODE:** ENG/OS/EA/CC/05/4/A

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements  ***(Bold and italicised terms are elaborated in the Range)*** |
| --- | --- |
| 1. Use and maintain drawing equipment and materials | 1.1 ***Drawing equipment*** are identified and gathered according to task requirements  1.2 ***Drawing materials*** are identified and gathered according to task requirements  1.3 Drawing equipment are used and maintained as per manufacturer’s instructions  1.4 Drawing materials are used as per workplace procedures  1.5 Waste materials are disposed in accordance with workplace procedures and ***environmental legislations***  1.6 ***Personal Protective Equipment*** is used according to occupational safety and health regulations |
| 1. Produce plane geometry drawings | * 1. Different types of lines used in drawing and their meanings are identified according to standard drawing conventions   2. Different types of ***geometric forms*** are constructed according to standard conventions   3. Different types of angles are constructed according to principles of geometry   4. Different types of angles are measured using appropriate measuring tools   5. Angles are bisected according to standard conventions   6. Freehand sketching of different types of geometric forms, tools, equipment, diagrams is conducted |
| 1. Produce solid geometry drawings | * 1. Drawings of patterns are interpreted according to standard conventions   2. Patterns are developed in accordance with standard conventions   3. Patterns are assembled as per standard conventions   4. Pattern assembly is interpreted as per standard conventions |
| 1. Produce orthographic drawings | * 1. Symbols and abbreviations are identified and their meaning interpreted according to standard drawing conventions   2. First and third angle orthographic drawings are produced and interpreted in accordance with the standard conventions   3. Orthographic elevations are dimensioned in accordance with standard conventions   4. Isometric drawings are produced and interpreted in accordance with standard conventions   5. Assembly drawing is produced and interpreted in line with the operating standards |
| 5. Produce electrical drawings | * 1. Electrical symbols and abbreviations are identified and their meaning interpreted according to BS 3939   2. Electrical diagrams and drawings are developed as per established standards   3. ***Electrical drawings*** are produced in accordance with BS 3939   4. Electrical drawings and diagrams are interpreted as per established standards |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance

| **Variable** | **Range** |
| --- | --- |
| 1. Drawing equipment may include but is not limited to: | * Drawing boards * T and set squares * drawing sets |
| 1. Drawing materials may include but is not limited to: | * Drawing papers * Pencils * Erasers * masking tapes * paper clips |
| 1. Environmental legislations may include but is not limited to: | * EMCA 1999 |
| 1. Personal Protective Equipment may include but is not limited to: | * Dust coats * closed leather shoes |
| 1. Geometric forms may include but is not limited to: | * Circles, triangles, rectangles, parallelogram, polygons, pyramids, conic sections, prisms, loci |
| 1. Standard conventions may include but is not limited to: | * Anatomy of engineering drawing (title block, coordinate grid system, revision block, notes and legends) * Drawing scale (paper size and drawing symbols) * International drawing standards |
| 1. Electrical drawings may include but is not limited to: | * Block * Schematic * Circuit * line * wiring diagrams |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required skills**

The individual needs to demonstrate the following skills:

* Critical thinking
* Drawing
* Interpretation
* Drawing equipment handling
* Analysis and synthesis
* Communication
* Inter personal

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Drawing equipment and materials
* Freehand sketching
* Lettering
* Geometrical constructions
* Types of drawings
* Types of lines
* Isometric drawing conventions, features, characteristics, components
* Orthographic drawing conventions, features, characteristics, components
* Sketches and drawings of simple patterns

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required knowledge and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Applied and adhered to safety procedures   2. Cared and maintained drawing equipment   3. Interpreted circuit, assembly and lay out diagrams   4. Applied appropriate technical standards, used proper tools and equipment for a given task   5. Produced sketches and drawings |
| 1. Resource Implications | Resources the same as that of workplace are advised to be applied.   * 1. Drawing room   2. Drawing equipment and materials |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Practical tests   2. Observation |
| 1. Context of Assessment | Competency may be assessed   * 1. On job   2. Off job   3. During Industrial Attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

**CORE UNITS OF COMPETENCY**

## PERFORM ELECTRICAL INSTALLATION

**UNIT CODE:** ENG/OS/EA/CR/01/4/A

**UNIT DESCRIPTION**

This unit covers the competencies required to perform an electrical installation work.

Installation work includes applying EHS standards, preparing working drawings, assembling tools, equipment and materials, performing electrical installation, terminating installation, inspecting and testing installation

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements  ***(Bold and italicised terms are elaborated in the Range)*** |
| --- | --- |
| 1. Apply EHS standards | * 1. Appropriate ***safety regulations*** are applied as per OSHA   2. ***Good housekeeping*** practices are applied as per standard operating procedures   3. Accidents, incidents and near misses are reported as per standard operating procedures   4. First aid is applied as per standard operating procedures |
| 1. Prepare working drawings | * 1. Design drawing is interpreted as per established standards   2. Symbols and nomenclatures are applied in accordance with British Standards [BS 3939]   3. Appropriate drawing tools are applied as per established standards   4. Components and their ratings are identified as per established procedure   5. Cable sizes and lengths are marked as per established procedures   6. Power supply and distribution circuits are drawn using line diagrams   7. Cable routes are indicated as per established procedures   8. Working drawing is prepared and any deviations from design drawing are shared with relevant parties as per the standard operating procedures |
| 1. Assemble tools, equipment & materials | * 1. Tools, equipment and materials are checked for the proper specifications and functionality as per established standards   2. Tools, equipment and materials are used as per established procedure   3. Tools and equipment are calibrated as per established standards   4. Tools, equipment and materials are assembled and stored as per the established procedure |
| 1. Perform electrical installation | * 1. Installation safety procedures are observed as per established standards   2. Working drawing is implemented as per established procedure   3. Installation is performed in line with IEE and other applicable standards   4. Cables, conductors, conduits, enclosures and support systems are installed to specifications using appropriate techniques, tools and equipment as per the working drawing   5. Labelling of the installation for identification is performed as per established standards   6. Disposal of waste materials is performed in line with environmental regulations |
| 1. Terminate installation | * 1. Cable lugging is performed as per the standards operating procedure.   2. Cables are terminated in accordance with IEE regulations   3. Labelling of the cables is performed as per the complexity of the job. |
| 1. Inspect and test installation | * 1. Type of tests are identified in line with installation parameters   2. Test is performed as per the IEE regulations   3. Firmness of the installation is established in line with standard operating procedures   4. Continuity test is performed as per standard operating procedure   5. Insulation resistance test is performed as per the IEE regulations   6. Ring circuit test is performed as per the standard operating procedure   7. Earth continuity test is performed as per the IEE regulations   8. Short circuit test is performed as per the IEE regulation |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance

| **Variable** | **Range** |
| --- | --- |
| * + - 1. Safety regulations may include but is not limited to: | * IEE regulations * Occupational Safety and Health Act (OSHA) * Work injury benefits Act (WIBA) |
| * + - 1. Good housekeeping may include but is not limited to: | * Adequate ventilation * Adequate lighting * clean and dry surfaces in the workplace * Avoid oil spillage * Tools in the appropriate storage place * Proper waste disposal in the designated places |
| * + - 1. Working drawings may include but is not limited to: | * Lighting and small power * Power distribution * Fire alarm and detection * Burglar alarm * CCTV * Access control * Electric fence |
| 1. Power supply may include but is not limited to: | * Single phase, 2 wire * Single phase 3 wire * 3phase 4wire * 3phase 5 wire * Dc: 2 wire and 3 wire |
| 1. Technical standards may include but is not limited to: | * IEE standard * British Standard * KEBS standard |
| 1. Service providers may include but is not limited to: | * Plumbers * Air conditioning * Data networks * Security * Carpenters * Masons * Welders * Fitters |
| 1. Services may include but is not limited to: | * Laying conduits/trays * Trunking * Providing temporary power * Installing power points |
| 1. Installation may include but is not limited to: | * Domestic installation * Commercial installation * Industrial Installation * Agriculture/ horticulture * Power Generator * Security * Water heating installations * Power transmission and distribution * IBMS (integrated building Management system) |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

* The individual needs to demonstrate knowledge and understanding of
* The manufacturer's warranty requirements relating to electrical installation systems and related components
* The legal requirements relating to electrical installations
* Kenyan legislation and workplace procedures relevant to:
* Health and safety;
* The environment (including waste disposal);
* Appropriate personal protective equipment (PPE).
* Workplace procedures for:
* Work place communication;
* Time management
* Team building and team work
* Notifying danger and hazard zones to workers
* Materials management
* The importance of documentation and keeping records
* The relationship between time and costs
* The importance of using the correct sources of technical information.
  + - Interpreting circuits, drawings, specifications and instructions
    - Preparing work plans in accordance with legislative and regulatory requirements, standard operating procedures and health and safety requirements
    - Referring and applying adjustable codes, numbers and standards at different circumstances

**FOUNDATION SKILLS**

The individual needs to demonstrate the following foundation skills:

* Communications (verbal and written);
* Time management;
* Technical drawing;
* circuit tracing;
* Use of measuring tools & equipment
* Problem solving;
* Decision making;
* Planning;
* First aid;
* Report writing;
* Creativity
* Customer care

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required knowledge and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Applied and adhered to safety procedures   2. Interpreted layouts/ circuit diagrams correctly   3. Applied appropriate technical standards   4. Used proper tools and equipment for a given task   5. Demonstrated safe selection, placing and wiring of cables/ wires, fixtures and fittings   6. IEE regulations were observed during installation   7. Installed functional electrical systems |
| 1. Resource Implications | Resources the same as that of workplace are advised to be applied.   * 1. Electrical installation tool kit, calculator, stationery   2. Electrical installation materials   3. Testing equipment   4. Storage facility |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Oral Questioning   2. Practical Tests   3. Written tests |
| 1. Context of Assessment | Competency may be assessed   1. On job 2. Off job 3. During Industrial Attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## INSTALL POWER SUPPLY SYSTEMS

**UNIT CODE:** ENG/OS/EA/CR/02/4/A

**UNIT DESCRIPTION**

This unit covers competencies required for installing power supply system. Competencies includes; identifying power supply system components, assembling tools, equipment and materials, installing power supply system, testing installed power supply system.

E**LEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements  ***(Bold and italicised terms are elaborated in the Range)*** |
| --- | --- |
| 1. Identify power supply system components | * 1. Power supply system components are identified as per DC input/output current and voltage   2. Power supply system components are identified as per AC input/output current and voltage   3. Power supply system components are identified in consideration of expected load on the system   4. Power supply system components are selected in consideration of environmental factors at the installation site   5. Power supply protection components are identified in line with input and output requirements |
| 1. Assemble tools, equipment and materials | * 1. Tools, equipment and materials are identified as per the tasks to be carried out   2. Tools, equipment and materials are assembled basing on their functionality   3. Tools, equipment and materials are assembled in line with safety standards   4. Tools, equipment and materials are assembled in accordance with precision required (digital instruments and analogue)   5. Printed circuit board are identified as per circuit design |
| 1. Install power supply system | * 1. Power supply system is installed in accordance with IEE regulations   2. Power supply system is installed in accordance with OSHA regulations   3. Power supply system is installed in line with standard operating procedures   4. Earthing/grounding of power supply system is performed as per IEE regulations   5. Waste disposal ‘is performed in line with established regulations |
| 1. Test power supply system | * 1. Power supply system components are tested in line with IEE regulations   2. Power supply system components are tested as per component parameters   3. Power supply system is tested based on expected functionality   4. Power supply system is tested in consideration of safety standards required |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

The individual needs to demonstrate knowledge and understanding of:

* Transformers
* Rectifiers
* Filters
* Inverters, converters
* Silicon controlled rectifiers
* Electrical standards
* Types of power supply systems
* Electrical design software
* Design tools
* Printed circuit boards and mother boards

**FOUNDATION SKILLS**

The individual needs to demonstrate the following additional skills:

* Electrical fabrication
* Electrical codes
* Knowledge of power supply systems
* Teamwork
* Soldering
* Decision making;
* Knowledge of “normal” electricity usage
* Environmental regulations
* Read and understand plans and symbols

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Identified power supply system components as per DC input/output current and voltage   2. Identified power supply system components in consideration of expected load on the system   3. Selected power supply system components in consideration of environmental factors at the installation site   4. Identified tools, equipment and materials as per the tasks to be carried out   5. Assembled tools, equipment and materials basing on their functionality   6. Identified printed circuit board as per circuit design   7. Installed power supply system is in accordance with OSHA regulations   8. Performed earthing/grounding of power supply system as per IEE regulations   9. Tested tower supply system components in line with IEE regulations   10. Tested power supply system in consideration of safety standards require |
| 1. Resource Implications | Resources the same as that of workplace are advised to be applied  Included: Soldering tools and materials, sizing tools, transformers, resistors, PCBs, capacitors, diodes, batteries, cables. |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Oral questioning   2. Written tests   3. Practical demonstration   4. Observation |
| 1. Context of Assessment | Competency may be assessed   1. On job 2. Off job 3. During Industrial Attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY ELECTRICAL INSTRUMENTATION

**UNIT CODE:** ENG/OS/EA/CR/03/4/A

**UNIT DESCRIPTION**

This unit covers the competencies required to apply electrical instrumentation. Competencies include; demonstrating understanding of measurements, applying electrical instruments, measuring electrical quantities, performing maintenance of electrical instruments.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***(Bold and italicised terms are elaborated in the Range)*** |
| --- | --- |
| 1. Demonstrate understanding of measurements | * 1. Electrical units are identified in accordance with engineering practices   2. Conversions of units is performed in line with standard operating procedure |
| 1. Apply electrical instruments | * 1. Meters are classified based on their functionality   2. ***Analogue*** meters are applied in line with standard operating procedures   3. ***Digital*** multimeters are applied in accordance with standard operating procedure   4. Clamp ammeters are applied as per standard operating procedure   5. Megohmmeters are applied as based on their functionality |
| 1. Measure electrical quantities | * 1. Perform measurement of resistance as per standard operating procedures   2. Determine the resistance value for various resistors based on their colour coding.   3. High resistance measurement are performed as per standard operating procedures   4. Perform measurement of voltage based on standard operating procedure   5. Perform measurement of current as per standard operating procedure   6. Measurement of insulation resistance is performed in line with standard operating procedures   7. Safety standards are observed when performing electrical measurements in accordance to OSHA regulations |
| 1. Perform maintenance of electrical instruments | * 1. Instruments to be repaired are identified in line with standard operating procedure   2. Cleaning, soldering and tightening of components are performed as per standard operating procedure   3. Defective parts are repaired based on established procedures   4. Repaired system components are configured in accordance to the instrument functionality   5. Maintenance activities are carried out in adherence to OSHA standards   6. Waste materials are disposed in adherence to EHS regulations   7. Repaired components are tested in accordance to manufacturer’s manuals |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| 1. Digital and analogue instruments includes but not limited to: | * Voltmeter * Ammeter * Ohmmeter * Wattmeter |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

The individual needs to demonstrate knowledge and understanding of:

* Analogue instruments
* Digital instruments
* Measurement
* Maintenance activities

**FOUNDATION SKILLS**

The individual needs to demonstrate the following additional skills:

* OSHA, WSHA, and industry safety procedures and regulations
* Operate test equipment and interpret results
* Troubleshooting
* Read and understand
* Symbols and schematics

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Identified electrical units in accordance with engineering practices   2. Performed conversions of units based on standard operating procedure   3. Applied analogue ammeters in line with standard operating procedures   4. Applied clamp ammeters as per standard operating procedure   5. Classified meters are based on their functionality   6. Performed measurement of resistance as per standard operating procedures   7. Performed high resistance measurement as per standard operating procedures   8. Performed measurement of current as per standard operating procedure   9. Performed cleaning, soldering and tightening of components are as per standard operating procedure   10. Configured instruments in accordance to the instrument functionality   11. Tested repaired components are in accordance to manufacturer’s manuals |
| 1. Resource Implications | Resources the same as that of workplace are advised to be applied  Included: Digital and analogue instruments etc. |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Oral questioning   2. Practical demonstration   3. Observation   4. Written tests |
| 1. Context of Assessment | Competency may be assessed   1. On job 2. Off job 3. During Industrial Attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## **MAINTAIN ELECTRICAL AND ELECTRONIC EQUIPMENT AND APPLIANCES**

**UNIT CODE:** ENG/OS/EA/CR/04/4/A

**UNIT DESCRIPTION**

This unit covers competencies required to perform electrical and electronic equipment and appliance Maintenance. Competencies includes: assembling maintenance tools, equipment and materials, inspecting and testing faulty components, performing maintenance activities and conducting tests on repaired equipment, appliance and assembling repaired equipment and appliance

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***(Bold and italicised terms are elaborated in the Range)*** |
| --- | --- |
| 1. Assemble maintenance tools, equipment and materials | * 1. Maintenance tools, equipment and materials are identified in regard to maintenance activities to be performed   2. A list of tools, equipment and materials are prepared in line with established procedure   3. Tools and equipment and materials are checked for specifications and functionality as per operating procedures   4. Tools and equipment are calibrated in line with standard operating procedure. |
| 1. Inspect and test faulty components | * 1. Disassembling of equipment and appliance is performed in line with manufacture’s manuals   2. Sorting of screws is performed in regard to standard operating procedures   3. Appliances are inspected in regard to established procedure   4. Tests to be performed are identified in regard to appliance functionality   5. Appliances are tested as per established procedures   6. Perform troubleshooting in line with established procedure   7. Testing is performed in adherence to safety standards |
| 1. Perform maintenance activities | * 1. System components to be repaired/replaced are identified based on the appliance functionality   2. Cleaning, soldering and tightening of components are performed as per standard operating procedure   3. Defective components/parts are repaired/replaced based on established procedures   4. Maintenance activities are carried out in adherence to OSHA standards   5. Waste materials are disposed adherence to EHS regulations |
| 1. Perform tests on repaired equipment and appliances | * 1. Type of tests to be carried out are identified in line with maintenance activities   2. Components to be tested are identified based on the system functionality   3. Repaired/replaced components are tested in accordance to manufacturer’s manuals |
| 1. Assemble repaired equipment and appliance | * 1. Tightening of screws is performed in accordance with standard operating procedures   2. Connectors are patched as per manufacture’s manuals   3. Cable ties, silicon glue, super glue and insulating tapes are applied in binding cables as per standard operating procedures   4. Mounting of cooling components is performed in line with manufacture’s manuals |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| Electrical and electronic equipment and appliances | * Radio * Television * Mobile phones * Set top boxes * Iron box * Electric kettles * Printers * Photocopiers * Microwaves * Instant shower * Refrigerator * Air conditioning systems * Microwave * Washing machine * Blenders |
| Safety and precautions measures includes but not limited to: | Are activities and precautions taken to improve safety in a workplace |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

The individual needs to demonstrate knowledge and understanding of:

* Troubleshooting techniques
* Repair/replacing of system components techniques
* Causes of system failures
* Knowledge in basic electricity
* Electrical safety and precautious measures
* Electrical shock prevention measures
* Performance monitoring techniques

**FOUNDATION SKILLS**

The individual needs to demonstrate the following additional skills:

* Communications (verbal and written);
* Computer literacy
* Electrical principles
* Physics
* Analytical skills
* Planning;
* Decision making;
* Report writing;
* Time management
* Faults troubleshooting
* Problem solving;

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Identified maintenance tools, equipment and materials in regard to maintenance activities to be performed   2. Checked tools and equipment and materials for specifications and functionality as per operating procedures   3. Performed disassembling of equipment and appliance in line with manufacture’s manuals   4. Inspected appliances are in regard to established procedure   5. Tested appliances in line with established procedures   6. Performed testing in adherence to safety standards   7. Repaired/replaced defective components/parts based on established procedures   8. Identified type of tests to be carried out in line with maintenance activities   9. Tested repaired/replaced components in accordance to manufacturer’s manuals   10. Patched connectors as per manufacture’s manuals   11. Mounting of cooling components is performed in line with manufacture’s manuals   12. Disposed waste materials are adherence to EHS regulations   13. Carried out maintenance activities in adherence to OSHA standards |
| 1. Resource Implications | Resources the same as that of workplace are advised to be applied  Included: radio, television, mobile phones, set top boxes, switches, iron boxes, refrigerator etc. |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Oral questioning   2. Practical demonstration   3. Observation   4. Written tests |
| 1. Context of Assessment | Competency may be assessed   1. On job 2. Off job 3. During Industrial Attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |