

**THE REPUBLIC OF KENYA**

**NATIONAL OCCUPATIONAL STANDARDS**

**FOR**

**ELECTRICAL INSTALLER**

**KNQF LEVEL 5**

**OCCUPATIONAL STANDARD ISCED CODE:** **0713 454A**

**First published 2023**

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# FOREWORD

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

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

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

It is my conviction that this Occupational standard will play a great role towards development of competent human resource for the Engineering Sector’s growth and sustainable development.

# PREFACE

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

The Technical and Vocational Education and Training CAP 210A of 2013 on Reforming Education and Training in Kenya, emphasized the need toreform curriculum development, assessment and certification. This called for a shift to CBET to address the mismatch between skills acquired through training and skills needed by industry as well as increase the global competitiveness of Kenyan labour force.

Industry experts in conjunction with experienced trainers from ………..developed this Occupational Standard.

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

I am grateful to the Council Members, Council Secretary, industrial experts in Electrical and Electronics Engineering, experienced trainers and all those who participated in the development of this Occupational Standard.

# ACKNOWLEDGEMENT

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

I recognize with appreciation the role of industry experts in Electrical Engineering in ensuring that competencies required by the industry are addressed in the curriculum. I also thank the experienced trainers for their valuable input and all those who participated in the process of developing this curriculum.

In addition, I thank TVET Authority (TVETA) for providing guidance on the development of this curriculum.

I am convinced that this curriculum will go a long way in ensuring that workers in Electrical and Electronics Engineering acquire competencies that will enable them to perform their work more efficiently

# ACRONYMS

BOQ Bill of Quantities

CAD Computer Aided Design

CCTV Closed Circuit Television

EHS Environment, Health and Safety

HVAC Heating, Ventilation and Air Conditioning

IET Institute of Electrical and electronics Engineers

KEBS Kenya Bureau of Standards

KP Kenya Power

SOP Standard operating procedure

NCA National Construction Authority

OSHA Occupational Safety and Health Act

PPE Personal Protective Equipment

PV Photo Voltaic

TVET Technical and Vocational Education and Training

WIBA Work injury benefits Act

# KEY TO UNIT CODE



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**OVERVIEW**

This course is designed to equip an Electrical Technician Level 5 with the competencies required to Perform Electrical Installation, fabricate electronic circuits, install power systems, install electrical machine, Automate Electrical systems, maintain electrical system, Install Security Systems and Manage Electrical Projects.

Electrical Technician is a person who will carry out electrical work using a given design and customer’s requirements. This work demands the technician to design, read and interpret electrical drawings so that the technician can install the system according to the national and international standards. Moreover, the size and quantity of all materials, cables, control equipment and accessories and speciﬁcations for the items necessary to install the electrical systems will largely be determined by the project owner and electrical technician. Therefore, an electrical technician is a well-trained person who can carry out these responsibilities

**SUMMARY OF UNITS OF COMPETENCY**

**BASIC UNITS OF COMPETENCY**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| 0031 441 01B | Apply Communication Skills |
| 0611 451 02B | Apply Digital skills |
| 0413 441 03B | Apply Entrepreneurial Skills |
| 0417 441 04B | Apply Work ethics and Practices |

**COMMON UNITS OF COMPETENCY**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| 0541 441 05A | Apply Engineering Technician Mathematics I |
| 0713 441 05A | Apply Engineering Technician Mathematics II |
| 0713 441 07A | Apply Electrical Principles |
| 0732 441 08A | Prepare Technical Drawings |
| 0714 441 09A | Apply Analogue Electronics 1 |
| 0714 441 09A | Apply Analogue Electronics 11 |
| 0714 441 10A | Apply Digital Electronics 1 |
| 0714 441 10A | Apply Digital Electronics 11 |

**CORE UNITS OF COMPETENCY**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| 0713 251 23A | PVC Sheathed Cable System |
| 0713 251 24A | Trunking System Installation |
| 0713 251 25A | Conduit System Installation |
| 0713 351 26A | Stand-Alone Solar PV System |
| 0713 351 27A | Bell and Alarm Installation |
| 0713 351 28A | Electrical Machine Winding |
| 0713 451 29A | Perform Electrical Installation |
| 0713 451 32A | Install Solar PV Systems |
| 0713 451 31A | Perform Electrical Machine Installation |
| 0713 451 33A | Perform Security Systems Installation |
| 0714 451 30A | Install Electrical Power lines |

# BASIC UNITS OF COMPETENCY

## APPLY COMMUNICATION SKILLS

**UNIT CODE: 0031 441 01B**

**UNIT DESCRIPTION**

This unit covers the competencies required to apply communication skills. It involves applying communication channels, written communication skills, non-verbal skills, oral communication skills, and group communication skills.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes that make up workplace function | **PERFORMANCE CRITERIA**  These are assessable statements that specify the required level of performance for each of the elements.  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Apply communication channels | 1. Specific communication channels are identified and applied based on workplace requirements. 2. Challenges are identified and addressed as per the operational standards of the organization. 3. Communication channels are evaluated to meet workplace needs. |
| 1. Apply written communication skills | * 1. Types of written communication are identified and applied according to the workplace requirements.   2. Written communication needs are identified and implemented according to workplace procedures.   3. Written communication guidelines are analyzed, evaluated, and revised based on workplace needs. |
| 1. Apply non-verbal communication skills | 3.1 Existing non-verbal communication techniques are identified and applied based on organization policy.  3.2 Non-verbal communication techniques are articulated and modeled to enhance inclusivity according to workplace requirements. |
| 1. Apply oral communication skills | 4.1 Types of oral communication are identified and established as per organization policy.  4.2 Pathways of oral communication are identified and established as per organization policy.  4.3 Pathways of oral communication are reviewed according to organization procedures.  4.4 Pathways of oral communication are maintained according to the organization standards. |
| 1. Apply group communication skills | 1. Group ***communication strategies*** are appliedbased on the workplace needs. 2. Groups are organized in accordance with workplace procedures. 3. Effective questioning, listening and non-verbal communication techniques are used as per needs.   5.4 Group communication challenges are identified and addressed according to the workplace needs. |

**RANGE**

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

| **Variable** | **Range** |
| --- | --- |
| 1. ***Communication strategies*** may include but are not limited to: | * Language switch * Comprehension check * Repetition * Asking confirmation * Paraphrasing * Clarification request * Translation * Restructuring * Generalization |

**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:

* Active listening
* Interpretation
* Negotiation
* Writing
* Oral skills
* Creative thinking
* Critical thinking
* Decision making
* Analytical
* Innovation
* Conflict skills
* Leadership
* Problem solving skills
* Management
* Organizational
* Teamwork

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Communication process
* Dynamics of groups
* Styles of group leadership
* Key elements of communications strategy
* Principles of effective communication
* Turn-taking techniques
* Conflict resolution techniques
* Work planning
* Work organization
* Company policies
* Company operations and procedure standards
* Fundamental rights at the workplace
* Personal hygiene
* Accountability
* Workplace problems and how to deal with them

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of Competency. | Assessment requires evidence that the candidate:   * 1. Identified and applied specific communication channels based on workplace requirements.   2. Identified and applied specific written communication correspondence according to the workplace requirements.   3. Applied and developed non-verbal strategies to communicate in all areas of the workplace requirements.   4. Established pathways of oral communication as per workplace policy.   5. Applied group communication strategies based on workplace needs. |
| 1. Resource Implications | The following resources should be provided:   * Access to relevant workplace where assessment can take place. * Appropriately simulated environment where assessment can take place. * Resources relevant to the proposed activity or tasks. |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Observation   2. Oral assessment   3. Portfolio of evidence   4. Interviews   5. Third party report   6. Written assessment   7. Practical assessment   8. Projects |
| 1. Context of Assessment | Competency may be assessed:   * On-the-job * In a simulated work environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY DIGITAL LITERACY

**UNIT CODE: 0611 441 02B**

**UNIT DESCRIPTION:**

This unit covers the competencies required to demonstrate digital literacy. It involves operating computer devices, solving tasks using the Office suite, managing data and information, performing online communication and collaboration, applying cybersecurity skills, and performing jobs online.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes that make up workplace functions | **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. Operate computer devices | * 1. C***omputer device*** usage is determined as per workplace requirements.   2. ***Computer hardware*** is identified according to job requirements.   3. ***Computer software*** is identified according to workplace requirements.   4. Computer devices are turned on or off as per the correct workplace procedure.   5. ***Mouse techniques*** are applied in solving tasks as per workplace requirements.   6. Keyboardtechniques are applied in solving tasks as per workplace requirements.   7. Computer files and folders are created and managed as per workplace requirements.   8. ***Internet connection option***s are identified and applied in connecting computer devices to the Internet.   9. ***External devices*** are identified and connected to the computer devices as per the job requirement. |
| 1. Solve tasks using Office suite | 1. ***Word processing concepts***are applied in solving workplace tasks as per job requirements. 2. Worksheet data is entered and prepared in accordance with work procedures. 3. Worksheet data is built and edited in accordance with workplace procedures. 4. ***Data manipulation*** on a worksheet is undertaken in accordance with work requirements. 5. Worksheets are saved and printed in accordance with job requirements. 6. ***Electronic presentation concepts***are applied in solving workplace tasks as per job requirements. |
| 1. Manage data and information | * 1. Office ***internet services*** are identified and applied in accordance with office procedures.   2. ***Internet access applications*** are determined in accordance with office operation procedures.   3. Internet search is performed as per job requirements.   4. Online digital content is downloaded in accordance with workplace requirements.   5. Digital content is identified and backed up in accordance with workplace procedures. |
| 1. Perform online communication and collaboration | * 1. Netiquette principles are observed as per work requirements.   2. Electronic mail communication is executed in accordance with workplace policy.   3. Digital content copyright and licenses are identified and applied according to workplace policies and regulatory requirements.   4. ***Online*** ***collaboration tools*** are applied in accordance with workplace policies and regulatory requirements. |
| 1. Apply cybersecurity skills | * 1. ***Data protection*** and ***privacy*** is classified in accordance with workplace policies and regulatory requirements.   2. ***Internet security threats*** are identified as per workplace policies and regulatory requirements.   3. Computer threats and crimes are detected in accordance to Information Management security guidelines.   4. ***Cybersecurity control measures*** are applied in accordance with workplace policies and regulatory requirements. |
| 1. Perform online jobs | * 1. ***Online job platforms*** are identified as per the job requirements.   2. Online accounts and profiles are created in accordance with the work requirements.   3. Online jobs are identified according to the bidder’s skillset.   4. Online digital identity is managed according to industry best practices.   5. Online job bidding is done as per the specific job requirements.   6. Online tasks are executed according to the job requirements.   7. Personal online payment account is managed in accordance with financial regulations. |

**RANGE**

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

| **Variable** | **Range** |
| --- | --- |
| 1. ***Computer devices*** may include but are not limited to: | * Desktops * Laptops * Smartphones * Tablets * Smartwatches |
| 1. ***Computer hardware*** may include but are not limited to: | * The System Unit E.g. Motherboard, CPU, casing, * Input Devices e.g. Pointing, keying, scanning, voice/speech recognition, direct data capture devices. * Output Devices e.g. hardcopy output and softcopy output * Storage Devices e.g. main memory e.g. RAM, secondary storage (Solid state devices, Hard Drives, CDs & DVDs, Memory cards, Flash drives * Computer Ports e.g. HDMI, DVI, VGA, USB type C etc. |
| 1. ***Computer software*** may include but are not limited to: | * System software e.g. Operating System (Windows, Macintosh, Linux, Android, iOS) * Application Software e.g. Word Processors, Spreadsheets, Presentations etc. * Utility Software e.g. Antivirus programs |
| 1. ***External devices*** may include but are not limited to: | * Printers * Projectors * Smart Boards * Speakers * External storage drives * Digital/Smart TVs |
| 1. ***Word processing concepts*** may include but are not limited to: | * Creating word documents * Editing word documents * Formatting word documents * Saving word documents * Printing word documents |
| 1. ***Mouse techniques*** may include but are not limited to: | * Clicking * Double-clicking * Right-clicking * Drag and drop |
| 1. ***Internet connection*** options may include but are not limited to: | * Mobile Networks/Data Plans * Wireless Hotspots * Cabled (Ethernet/Fiber) * Dial-Up * Satellite * ISDN (Integrated Services Digital Network) |
| 1. ***Data manipulation*** may include but are not limited to: | * Use of formulae * Use of functions * Sorting * Filtering * Visual representation using charts |
| 1. ***Electronic presentation concepts*** may include but are not limited to: | * Creating slides * Editing slides * Formatting slides * Applying slide effects and transitions * Creating and playing slideshows * Saving presentations * Printing slides and handouts |
| 1. ***Internet services*** may include but are not limited to: | * Communication Services * Information Retrieval Services * File Transfer * World Wide Web Services * Web Services * Directory Services * Automatic Network Address Configuration * NewsGroup * Ecommerce |
| 1. ***Internet access applications/software*** may include but are not limited to: | * Browsers * Email Apps * eCommerce Apps |
| 1. ***Online collaboration tools*** may include but are not limited to: | * Online Storage * Online productivity applications * Online meetings, * Online learning environments, * Online calendars * Social networks |
| 1. ***Data protection and privacy*** may include but not limited to: | * Confidentiality of data/information * Integrity of data/information * Availability of data/information |
| 1. ***Internet security threats*** may include but not limited to: | * Malware attacks * Social engineering attacks * Software supply chain attacks * Advanced persistent threats (APT) * Distributed denial of service (DDoS) * Man-in-the-middle attack (MitM) * Password attacks * IoT Attacks * [Phishing Attacks](https://onlinedegrees.sandiego.edu/top-cyber-security-threats/#phishing-attacks) * [Ransomware](https://onlinedegrees.sandiego.edu/top-cyber-security-threats/#ransomware) |
| 1. ***Security threats*** control measures may include but not limited to: | * Counter measures against cyber terrorism * Physical Controls * Technical/Logical Controls * Operational Controls |
| 1. ***Online job platforms*** may include but are not limited to: | * Remotask * Data annotation.tech * Cloudworker * Upwork * Oneforma * Appen |
| 1. ***Job opportunities*** may include but not limited to: | * Self employment * Service provision * product development * salaried employment |
| 1. ***Certificates and testimonials*** may include but not limited to: | * Academic credentials * Letters of previous employments/ services rendered * Letters of commendation * Certifications of participation * Awards |
| 1. ***Interview skills*** may include but not limited to: | * Listening skills * Grooming * Language command * Articulation of issues * Body language * Time management * Honesty * Generally knowledgeable in current affairs and technical area |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Computer Hardware and Software Concepts
* Computer Security Concepts (Data security and privacy)
* Cyber security threats and control measures
* Understanding Computer Crimes
* Detection and protection against computer crimes
* Laws governing protection of ICT in Kenya
* Digital Identity Management
* Netiquette Principles
* Fundamentals of Copyright and Licenses
* Word processing;

Functions and concepts of word processing;

Documents and tables creation and manipulations;

Document editing;

Document formatting;

Word processing utilities

* Spreadsheets;

Meaning, types and importance of spreadsheets;

Components of spreadsheets;

Functions, formulae, and charts, uses and layout;

Data formulation, manipulation and application to cells;

Editing & formatting spreadsheets;

* Presentation Packages;

Types of presentation Packages.

Creating, formulating, running, editing, printing and presenting slides and handouts

* Networking and Internet;

Internet connectivity.

Browser and digital content management;

Managing data, information, and digital content

Electronic mail and World Wide Web

* Fundamentals of Online Working;

Online Profile Management;

e-Portfolio Management;

Online Jobs Bidding;

Online Payment Systems;

**Required skills**

The individual needs to demonstrate the following skills:

* Active listening
* Keyboard Skills
* Mouse Skills
* Analytical skills
* Creativity
* Interpretation Skills
* Communication
* Spreadsheet operations (applying fundamental operations such as addition, subtraction, division and multiplication)
* Computer Use Safety Skills
* Document Editing Skills
* Document Formatting Skills
* Document Printing Skills
* Netiquette Skills
* Internet Browsing Skills
* Problem Solving Skills
* Online Collaboration Skills
* Cybersecurity Skills
* CV writing
* grooming

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate***:***   * 1. Operated computer devices as per workplace policies and regulations.   2. Solved tasks using the office suite as per workplace policies and regulations.   3. Manage data and information as per workplace policies and regulations.   4. Performed online communication and collaboration as per workplace policies and regulations.   5. Applied cybersecurity skills in accordance with workplace policies and regulations.   6. Executed online tasks according to the job requirements.   7. Searched for job opportunity based on competencies.   8. Prepared job requirement documentations based on job opportunity.   9. Demonstrated interview skills based on the job opportunity. |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place.   2. Access to relevant work environments where assessment can take place.   3. Resources relevant to the proposed activities or task. |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Observation   2. Oral assessment   3. Portfolio of evidence   4. Interviews   5. Third party report   6. Written assessment   7. Practical assessment   8. Projects |
| 1. Context of assessment | Competency may be assessed in:   * 1. Workplace or simulated workplace. |
| 1. Guidance information for assessment | * 1. Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

## APPLY ENTREPRENEURIAL SKILLS

**UNIT CODE : 0413 441 03B**

**UNIT DESCRIPTION**

This unit covers competences required to apply entrepreneurship. Competences include applying financial literacy skills, applying entrepreneurial concepts, identifying entrepreneurship opportunities, applying business legal aspects, developing business innovative strategies, and developing business plans.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes that make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements that specify the required level of performance for each of the elements.  ***(Bold and italicized terms are elaborated in Range)*** |
| --- | --- |
| 1. Apply Financial Literacy Skills | 1. ***Sources of personal and business*** ***funds*** are identified as per financial procedures and standards 2. Personal finances are managed as per financial procedures and standards 3. Savings are managed as per financial procedures and standards 4. Debts are managed as per financial procedures and standards 5. Investments are undertaken as per financial procedures and standards 6. Insurance services are procured as per financial procedures and standards |
| 1. Apply entrepreneurial concept | 1. Entrepreneurs and Business persons are distinguished as per principles of entrepreneurship 2. ***Types of entrepreneurs*** are identified as per principles of entrepreneurship 3. Ways of becoming an entrepreneur are identified as per principles of Entrepreneurship 4. ***Characteristics of Entrepreneurs*** are identified as per principles of Entrepreneurship 5. Salaried employment and self-employment are distinguished as per principles of entrepreneurship 6. ***Requirements for entry into self-employment*** are identified according to business procedures and standards 7. Roles of an Entrepreneur in an enterprise are determined according to business procedures and standards 8. **Contributions of entrepreneurship** to National development are identified as per business procedures and standards |
| 1. Identify entrepreneurial opportunities | 1. Business ideas are identified as per business procedures and standards 2. Factors to consider when evaluating business opportunity viability are explored based on business procedure and standards 3. Entrepreneurial opportunities are evaluated as per business procedures and standards 4. Business ideas and opportunities are generated as per business procedures and standards 5. Business life cycle is analysed as per business procedures and standards |
| 1. Apply business legal aspects | 1. ***Forms of business ownership*** are identified as per legal procedures and practices 2. Business Registration and Licensing processes are identified as per legal procedures and practices 3. Types of Contracts and Agreements are analysed as per legal procedures and practices 4. Employment Laws are identified as per legal procedures and practices 5. Taxation laws are identified as per legal procedures and practices |
| 1. Innovate Business strategies | 1. Business innovation strategies are determined by the organization standards 2. Creativity in business development is demonstrated in accordance with business standards 3. ***Innovative business standards***  are developed as per business principles 4. Linkages with other entrepreneurs are created as per best practice 5. ICT is incorporated in business growth and development as per best practice |
| 1. Develop Business Plan | 1. Business idea is described as per business procedures and standards 2. Business description is developed as per business plan format 3. Marketing plan is developed as per business plan format 4. Organizational/Management plan is prepared in accordance with business plan format 5. Production/operation plan is prepared in accordance with business plan format 6. Financial plan is prepared in accordance with the business plan format 7. Executive summary is prepared in accordance with business plan format 8. Business plan is presented as per best practice 9. Business ideas are incubated as per institutional policy. |

**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. ***Sources of personal funds*** mayinclude but not limited to: | * Salary/Wages * Investments * Savings * Inheritance * Government Benefits |
| 1. ***Sources of business finance*** mayinclude but not limited to: | * Equity Financing * Debt Financing, * Personal Savings/Investment * Retained Earnings * Grants and Subsidies * Crowdfunding * supplier Credit: * Leasing and Asset Financing: |
| 1. ***Types of entrepreneurs*** may include but not limited to: | * Innovators * Imitators * Craft * Opportunistic * Speculators |
| 1. ***Characteristics of Entrepreneurs*** may include but not limited to: | * Creative * Innovative * Planner * Risk taker * Networker * Confident * Flexible * Persistent * Patient * Independent * Future oriented * Goal oriented |
| 1. ***Requirements for entry into self-employment*** may include but not limited to | * Technical skills * Management skills * Entrepreneurial skills * Resources * Infrastructure |
| 1. ***Forms of businesses ownership*** may include but not limited to: | * Sole proprietorship * Partnership * Limited companies * Cooperatives |
| 1. ***Innovative business standards*** may include but not limited to: | * New products * New methods of production * New markets * New sources of supplies * Change in industrialization |

**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
* Management
* Problem-solving
* Root-cause analysis
* Communication

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Decision making
* Business communication
* Change management
* Competition
* Risk
* Net working
* Time management
* Leadership
* Factors affecting entrepreneurship development
* Principles of Entrepreneurship
* Features and benefits of common operational practices, e. g., continuous improvement (kaizen), waste elimination,
* Conflict resolution
* Health, safety and environment (HSE) principles and requirements
* Customer care standards
* Basic financial management
* Business strategic planning
* Impact of change on individuals, groups and industries
* Government and regulatory processes
* Local and international market trends
* Product promotion standards
* Market and feasibility studies
* Government and regulatory processes
* Local and international business environment
* Relevant developments in other industries
* Regional/ County business expansion standards

**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 sources of personal and business finance as per financial procedures and standards. 2. Managed personal finances as per financial procedures and standards. 3. Made investment decisions as per financial procedures and standards. 4. Generatedbusiness ideas and opportunities based on business procedure and standards. 5. Analysed business life cycle based on business procedure and standards. 6. Determined business innovative standards as per business principles. 7. Developed and presented a business plan as per regulatory framework. |
| 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 may be assessed through:   1. Written tests 2. Oral questions 3. Third party report 4. Interviews 5. Portfolio |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. In a simulated work environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY WORK ETHICS AND PRACTICES

**UNIT CODE: 0417 441 04B**

**UNIT DESCRIPTION**

This unit covers competencies required to apply work ethics and practices. Competencies include applying self-management skills, promoting ethical work practices and values, promoting teamwork, maintaining professional and personal development, applying problem-solving and promoting customer care.

**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 Range)*** |
| --- | --- |
| 1. Apply self-management skills | 1. Personal vision, mission and goals are formulated based on potential and concerning organization objectives and strategic plan. 2. Self-esteem and a positive self-image are developed and maintained based on value. 3. Emotional intelligence and stress management are demonstrated as per workplace requirements. 4. Assertiveness is developed and maintained based on the requirements of the job. 5. Accountability and responsibility for one's actions are demonstrated based on workplace instructions. 6. Time management, attendance and punctuality are observed as per the organization’s policy. 7. Personal goals are managed as per the organization’s objective. 8. Self-strengths and weaknesses are identified based on personal objectives. 9. Motivation, initiative and proactivity are utilized as per the organization policy. 10. Individual performance is evaluated and monitored according to the agreed targets. |
| 1. Promote ethical work practices and values | 1. Integrity is demonstrated as per acceptable norms. 2. Codes of conduct is applied as per the workplace requirements. 3. Policies and guidelines are observed as per the workplace requirements. 4. Professionalism is exercised in line with organizational policies. |
| 1. Promote Team work | 3.1 ***Teams*** are formed to enhance productivity based on organization’s objectives.  3.2 Duties are assigned to teams under the organization policy.  3.3 Team activities are managed and coordinated as per set objectives.  3.4 Team performance is evaluated based on set targets as per workplace policy.  3.5 ***Conflicts*** are resolved between team members in line with organization policy.  3.6 Gender and diversity-related issues are identified and mainstreamed in accordance with workplace policy.  3.7 Healthy ***relationships*** are developed and maintained in line with the workplace.  3.8 Adaptability and flexibility are applied in dealing with team members as per workplace policies. |
| 1. Maintain professional and personal development | 4.1 ***Personal growth and development*** needs are identified and assessed in line with the requirements of the job.  ***4.2 Training and career opportunities*** are identified and utilized based on job requirements.  4.3 ***Resources*** for training are mobilized and allocated based on organizations and individual skills needs.  4.4 Licenses and certifications relevant to the job and career are obtained and renewed as per policy.  4.5 Recognitions are sought as proof of career advancement in line with professional requirements.  4.6 Work priorities and personal commitments are balanced and managed based on the requirements of the job and personal objectives.  4.7 Dynamism and on-the-job learning are embraced in line with the organization’s goals and objectives. |
| 1. Apply Problem solving skills | 5.1 ***Creative, innovative*** and practical solutions are developed based on the problem  5.2 Independence and initiative in identifying and solving problems are demonstrated based on the requirements of the job.  5.3 Team problems are solved as per the workplace guidelines.  5.4 Problem-solving strategies are applied as per the workplace guidelines.  5.5 Problems are analyzed and assumptions tested as per the context of data and circumstances. |
| 1. Promote Customer Care | 6.1 Customers' needs are identified based on their characteristics.  6.2 Customer ***feedback*** is allowed and facilitated in line with organization policies.  6.3 Customer concerns and complaints are analyzed and resolved in line with the set organizational culture.  6.4 Proactive customer outreach programs are implemented as per organizational policies.  6.5 Customer retention strategies are developed and implemented in line with the organizational policy. |

**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. ***Feedback*** may include but not limited to: | * Verbal * Written * Informal * Formal |
| 1. ***Conflicts*** mayinclude but are not limited to: | * Interpersonal Conflict. * Intrapersonal Conflict. * Intergroup Conflict. * Intragroup Conflict. |
| 1. ***Relationships*** may include but not limited to: | * Man/Woman * Trainer/trainee * Employee/employer * Client/service provider * Husband/wife * Boy/girl * Parent/child * Sibling relationships |
| 1. ***Team*** may include but not limited to: | * Small work group * Staff in a section/department * Inter-agency group * Virtual teams |
| 1. ***Personal growth*** may include but not limited to: | * Growth in the job * Career mobility * Gains and exposure the job gives * Net workings * Benefits that accrue to the individual as a result of noteworthy performance |
| 1. ***Personal objectives*** may include but not limited to: | * Long term * Short term * Broad * Specific |
| 1. ***Trainings and career opportunities*** may include but not limited to | * Participation in training programs * Serving as Resource Persons in conferences and workshops * Capacity building |
| 1. ***Resource*** may include may but not limited to: | * Human * Financial * Technology |
| 1. ***Creative and innovative*** may include but not limited to: | * New ideas * Original ideas * Different ideas * Methods/procedures * Processes * New tools |
| 1. ***Emerging issues*** may include but not limited to: | * Artificial Intelligence * Data confidentiality * National cohesion * Open offices |

**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:

* Active listening
* Critical thinking
* Organizational
* Negotiation
* Monitoring
* Evaluation
* Problem solving
* Decision Making
* Leadership
* Creative/innovative thinking
* Adaptability
* Conflict management
* Emotional intelligence
* Teamwork

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Work values and ethics
* Company policies and procedures
* Company operations, procedures and standards
* Flexibility and adaptability
* Concept of time and leisure time
* Decision making
* Work planning
* Organizing work
* Monitoring and evaluation
* Record keeping
* Gender and diversity mainstreaming
* Drug and substance abuse
* Professional growth and development
* creativity
* Innovation
* problem solving
* customer care
* mentoring and coaching.
* Emerging 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 require evidence that the candidate:   * 1. Applied self-management skills as per organizational procedures.   2. Promoted ethical practices and values as per organizational procedures.   3. Promoted Teamwork as per workplace assignments.   4. Maintained professional and personal development as per organizational procedures.   5. Applied Problem-solving skills based on work requirements.   6. Identified customer needs based on their characteristics.   7. Gave back Customer feedback in line with organization policies. |
| 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. 3. Resources relevant to the proposed activity or tasks. |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Observation 2. Oral questioning 3. Written test 4. Portfolio of Evidence 5. Interview 6. Third party report |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. In a simulated work environment |
| 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

## APPLY ENGINEERING TECHNICIAN MATHEMATICS 1

**UNIT CODE:** **0541 441 05A**

**UNIT DESCRIPTION**

This unit describes the competencies required to apply a wide range of engineering technician mathematics. Competencies include: applying number systems, applying algebra, applying trigonometry and hyperbolic functions, performing coordinates geometry and carrying out binomial expansions.

**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 thse Range.*** |
| --- | --- |
| * + 1. Apply number systems | * 1. Calculations involving various types of numbers are performed as per the concept.   2. ***Arithmetic operations*** on integers are carried out as per the concept.   3. Mathematical problems are solved as per concepts. |
| * + 1. Apply algebra | * 1. Indices calculations are performed as per the concept.   2. ***Simultaneous equations*** involving 2 and 3 unknowns are performed as per the rules.   3. Mathematical problems are solved as per concepts.   4. Quadratic equations are calculated as per the concept |
| * + 1. Apply Trigonometry and Hyperbolic functions | * 1. Triangle sides and angles are calculated as per trigonometric ratios.   2. Triangle sides and angles are calculated as per trigonometric rules.   3. Triangle areas are calculated as per Hero’s formula.   4. ***Trigonometric functions*** for given arguments are evaluated as per the concept.   5. Conversion of Trigonometric and hyperbolic identities are performed as per Osborn’s rule   6. ***Hyperbolic functions*** for given arguments are evaluated as per the concept. |
| * + 1. Perform Coordinates geometry | * 1. Convert polar equations to Cartesian equations as per the concept   2. Convert Cartesian equation to polar equation as per the concept   3. Plot graphs of polar equations as per the concept   4. ***Determine normal and tangents*** using co-ordinate geometry. |
| * + 1. Carry out binomial expansion | * 1. Derive power series of simple functions using binomial expansion   2. Estimate errors of small changes using binomial expansion   3. ***Estimate roots of numbers*** using binomial expansion |

**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. ***Arithmetic operations***include but not limited to: | * Addition * Subtraction * Multiplication * Division |
| * 1. ***Simultaneous equations*** include but not limited to: | * Substitution * Elimination * Graphical |
| * 1. ***Trigonometric and hyperbolic functions*** include but not limited to: | * Trigonometric equations * Trigonometric identities * Osborn’s Rule * series expansion of coshx, sinhx,tanhx * Inverse hyperbolic functions * Hyperbolic log forms * Hyperbolic equations |
| * 1. ***normal and tangents*** include but not limited to: | * polar equations * Cartesian equations * Normal and tangents |
| * 1. ***roots of numbers*** include but not limited to: | * Power series using binomial theorem * Roots of numbers using binomial theorem |

**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
* Applying statistics
* Drawing graphs
* Using different measuring tools

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Fundamental operations (addition, subtraction, division, multiplication)
* Trigonometric Ratios
* Hyperbolic ratios
* Types of tables and graphs
* Indices and logarithms
* Quadratic equations
* Binomial theorem

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   * 1. Carried out arithmetic operations on integers as per concept.   2. Solved Indices calculations as per concept.   3. Solved simultaneous equations involving 2 and 3 unknowns as per rules.   4. Solved quadratic equations as per concept.   5. Solved trigonometric equations as per the concept   6. Proved trigonometric identities   7. Carried out series expansion of coshx, sinhx, tanhx   8. Carried out inverse hyperbolic functions   9. Carried out hyperbolic log form operations   10. Solved hyperbolic equations as per the concept   11. Solved polar equations   12. Solved Cartesian equations   13. Solved normal and tangents   14. Carried out power series expansion using binomial theorem   15. Solved roots of numbers using binomial theorem   16. Carried out Matrices Operations as per concept.   17. Obtained determinant and inverse of 2x2 matrix as per concept.   18. Obtained solutions of simultaneous equations as per matrix concept.   19. Obtained Measures of central tendencies as per statistics concept.   20. Carried out Data presentation as per statistics concept.   21. Determined derivatives of functions as per first principle.   22. Determined rate of change and small change as per differentiation concept.   23. Determined algebraic function Integrals as per integration rules   24. Determined trigonometric functions Integrals as per integration rules. |
| 2.Resource Implications | The following resources should be provided:  2.1Access to relevant workplace or appropriately simulated environment where assessment can take place  2.2Materials relevant to the proposed activity or tasks |
| 3.Methods of Assessment | Competency may be assessed through:   * 1. Written tests   2. Practical Assessment   3. Projects |
| 4.Context of Assessment | Competency may be assessed in a workplace or a simulated workplace. |
| 5.Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY ENGINEERING TECHNICIAN MATHEMATICS 11

**UNIT CODE:** 0541 441 06A

**UNIT DESCRIPTION:** This unit describes the competencies required to apply a wide range of engineering technician mathematics. Competencies include applying calculus, applying statistics and probability, applying matrices, applying vector theory and applying complex numbers.

**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 calculus | 1. Derivatives of functions are determined as per mathematical methods. 2. Differentiation is applied as per mathematical methods. 3. Integrals of functions are determined as per mathematical methods. 4. Integration is applied as per mathematical methods |
| 1. Apply statistics and probability | * 1. ***Measures of central tendency*** are obtained as per mathematical methods.   2. ***Measures of dispersion*** are obtainedas per mathematical methods.   3. Laws of probability are applied as per mathematical methods.   4. ***Probability distribution*** methods are applied as per mathematical methods.   5. Sampling distribution methods are applied as per mathematical methods. |
| 1. Apply vector theorem | * 1. Vectors and scalar quantities are defined as per mathematical methods   2. ***Operations*** on vectors are performed as per mathematical methods   3. Position vectors are determined as per mathematical methods   4. Resolution of vectors is performed as per mathematical methods   5. Vector and scalar products are obtained as per mathematical methods |
| 1. Apply matrices | * 1. Matrices operations are performed as per mathematical methods   2. Inverse of matrices are obtained as per mathematical methods   3. Simultaneous equations are solved using matrices as per mathematical methods. |
| 1. Apply complex numbers | * 1. Complex numbers are represented on Argand diagrams as per Mathematical methods   2. ***Operations*** involving complex numbers are performed as per mathematical methods   3. De Moivre’s theorem is applied as per mathematical methods |

**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** |
| --- | --- |
| Measures of central tendency may include but not limited to: | * Mean * Median * mode |
| Measures of dispersion may include but not limited to | * Co-efficient of Range. * Co-efficient of Variation. * Co-efficient of Standard Deviation. * Co-efficient of Quartile Deviation. * Co-efficient of Mean Deviation |
| Probability distributions may include but not limited to: | * Binomial distribution * Poisson distribution * Normal distribution |
| Operations may or include but not limited to; | * Addition * Subtraction * Multiplication * Division |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

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
* Applying statistics
* Drawing graphs
* Using different measuring tools

**Required Knowledge**

The individual needs to demonstrate knowledge and understanding of:

* Algebra
* Linear algebra
* Basic calculus
* Geometry
* 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 understanding and range.

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   1. Applied complex numbers as per mathematical methods 2. Applied calculus as per mathematical methods 3. Applied statistics as per mathematical methods 4. Applied concept of probability as per mathematical methods 5. Applied vector as per mathematical methods 6. Applied matrices as per mathematical methods |
| 1. Resource implications | The following resources should be provided:   1. Mathematical tables 2. Whiteboards 3. Marker 4. Scientific calculator 5. Measuring equipment |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Observation   2. Oral assessment   3. Portfolio of evidence   4. Interviews   5. Third party report   6. Written assessment   7. Practical assessment   8. Projects |
| 1. Context of assessment | Competency may be assessed:   * 1. Workplace or simulated workplace. |
| 1. Guidance information for assessment | 1. Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended |

## APPLY ELECTRICAL PRINCIPLES

**UNIT CODE: 0713 441 07A**

**UNIT DESCRIPTION**

This unit describes competences required to apply Electrical principles 1 in their work. It involves applying electrical quantities, using cells and batteries, apply concepts of DC circuit, applying magnetism and electromagnetism, applying electrostatics principles, and performing electrical measurements.

**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 Electrical quantities | 1. Electrical quantities and units are identified as per SI systems 2. Calculations involving various electrical quantities are performed as per formula. 3. Electrical quantities measuring instruments are identified as per IEC standards. |
| 1. Use cells and batteries | 1. Simple cells are constructed as per work procedure. 2. ***Types of cells and batteries*** are identified as per work requirement. 3. E.M.F and internal resistance of cells is determined as per the measurement. 4. Maintenance of batteries is carried out based on manufacturer’s specification. 5. Applications of batteries are identified as per work requirement. |
| 1. Apply Concepts of DC circuit | * 1. Resistance and resistivity is determined in DC circuit as per IEC standards.   2. Calculations involving parallel and series circuits are performed based on DC circuit.   3. Calculations involving ***basic*** ***electrical laws*** are performed based on DC circuit. |
| 1. Apply magnetism and electromagnetism | * 1. ***Magnetic and non-magnetic materials*** are identified as per IEC standards.   2. Concepts of magnetic fields and field distribution are described as per magnetic laws.   3. Concepts of electromagnetism are applied based on magnetic properties.   4. Laws of electromagnetic induction are identified based on magnetic fields.   5. Concepts of self and mutual induction are applied as per electromagnetic laws. |
| 1. Apply Electrostatics principles | * 1. Electrostatics quantities are identified as per type of charges.   2. ***Types of capacitors*** are identified as per application requirement.   3. ***Calculations involving capacitors*** in series and parallel are performed as per electrostatic quantities.   4. Capacitors are applied in electrical circuits as per application requirement.   5. Capacitors are tested as per IEC standards. |
| 1. Perform electrical measurements | * 1. Types of instruments are identified as per work procedure.   2. Construction and operation of instruments is demonstrated as per work procedure.   3. ***Methods of range extension*** are applied as per work procedure.   4. Null-indicating instruments are identified as per work procedure.   5. Calculations involving electrical instruments are performed as per the formula.   6. Instrumental/systematic errors and mitigations are demonstrated as per work requirement.   7. Calculations involving systematic errors are performed as per the formula. |

**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. ***Types of cells and batteries*** may include but not limited to: | * + Dry cells   + Leclanché   + Mercury   + Lead-acid   + Alkaline   + Lithium |
| 1. ***Basic Electrical laws*** may include but not limited to: | * + Ohms law   + Kirchhoff’s theorem |
| 1. ***Magnetic and non-magnetic materials*** may include but not limited to: | * + Magnetic materials   + Non-magnetic materials   + Laws of electromagnetic induction   + Self and mutual induction   + Hysteresis loop   + Series and parallel magnetic circuit calculations |
| 1. ***Types of capacitors*** may include but not limited to: | * + Paper   + Ceramic   + Electrolytic   + Aluminium foil   + Polyester   + Tantalum   + Multiplate |
| 1. ***Calculations involving***   ***capacitors*** | * + Series   + Parallel   + Series parallel |
| 1. ***Methods of power factor correction*** | * + Capacitor bank |
| 1. ***Methods of range extension*** | * + Shunt and ammeter method   + Universal shunt method   + Multi-range voltmeter method   + D.C valve voltmeter. |

**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
* Power factor correction
* Logical thinking
* Problem solving
* Applying statistics
* 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
* Power triangle
* SI units of various electrical parameters
* 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. Performed calculations involving various electrical quantities as per formula. 2. Constructed Simple cells as per work procedures. 3. Identified types of cells and batteries as per work requirement. 4. Identified applications of batteries as per work requirement. 5. Carried out maintenance of batteries based on manufacturer’s specification. 6. Applied concepts of DC circuit. 7. Applied concepts of magnetism and electromagnetism. 8. Applied principles of electrostatics. 9. Performed electrical measurements. |
| 1. Resource Implications | The following resources should be provided:  2.1 Appropriately simulated environment where assessment can take place.   * 1. Access to relevant work environments.   2.3 Resources relevant to the proposed activities or task. |
| 1. Methods of Assessment | * 1. Practical demonstration   2. Projects   3. Written tests   4. Oral test |
| 1. Context of Assessment | Competency may be assessed in a workplace or a simulated workplace. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## PREPARE TECHNICAL DRAWINGS

**UNIT CODE: 0732 441 08A**

**UNIT DESCRIPTION**

This unit covers competences required to prepare technical drawings. Competences include preparing drawing equipment and materials, producing plane geometry drawings, producing pictorial orthographic drawings of components, managing basic operations in AutoCAD, developing Drawings in AutoCAD, Producing 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. Prepare drawing equipment and materials | | 1. ***Drawing equipment*** are identified according to task requirements 2. ***Drawing materials*** are identified according to task requirements 3. Drawing equipment are used as per technical drawing standards 4. Drawing equipment are maintained as per technical drawing standards 5. Drawing materials are used as per workplace procedures 6. Waste materials are disposed in accordance with workplace procedures and environmental legislations | |
| 1. Produce plane geometry drawings | | 1. Different types of lines used in drawing and their meanings are identified according to technical drawing standards 2. Freehand printing of letters and numbers carried out as per technical drawing standards 3. Borderlines and title blocks are drawn as per technical drawing standards. 4. Different types of angles are constructed as per technical drawing standards 5. Different types of ***geometric figures*** are constructed as per required dimensions 6. Different types of ***Tangents*** are constructed according to technical drawing standards. | |
| 1. Produce pictorial and orthographic drawings of components | | 1. Different symbols and abbreviations are identified, and their meaning interpreted as per technical drawing standards. 2. Pictorial sketches and ***pictorial drawings*** of components are interpreted and produced as per technical drawing standards. 3. First and third angle orthographic sketches and drawings of components are interpreted and produced as per technical drawing standards. 4. Different types of geometric forms, tools and equipment is freehand sketched as per technical drawing 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 not limited to: | * Drawing boards * T and set squares * Drawing set |
| 1. ***Drawing materials*** may include but not limited to: | * Drawing papers * Pencils * Erasers * Masking tapes * 2.5 Paper clips |
| 1. ***Geometric figures*** may include but not limited to: | * Circles * Triangles * Rectangles * Parallelogram * Polygons * Pyramids * Conic sections * Prisms |
| 1. ***Tangents*** may include but not limited to: | * Exterior tangents to a circle * Interior tangents to a circle |
| 1. ***Pictorial drawings*** may include but not limited to: | * Isometric drawing * Free hand sketches * Oblique drawing |

**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
* Basic computer skills
* 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:   * Used drawing equipment as per technical drawing standards. * Used drawing materials as per workplace procedures. * Identified different types of lines used in drawing and their meanings according to technical drawing standards. * Constructed different types of angles as per technical drawing standards. * Constructed different types ofTangents according to technical drawing standards. * Constructed different types of geometric figures as per required dimensions. * Produced pictorial sketches and pictorial drawings of components as per technical drawing standards. * Produced First and third angle orthographic sketches and drawings of components as per technical drawing standards. * Freehand sketched different types of geometric forms, tools and equipment as per technical drawing standards |
| 1. Resource Implications | The following resources should be provided:  2.1 Appropriately simulated environment where assessment can take place.  2.2 Access to relevant work environments.  2.3 Resources relevant to the proposed activities or task. |
| 1. Methods of Assessment | * 1. Practical demonstration   2. Projects   3. Written tests   4. Oral test |
| 1. Context of Assessment | Competency may be assessed in a workplace or a simulated workplace. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY ANALOGUE ELECTRONICS I

**UNIT CODE:** **0714 541 09A**

**UNIT DESCRIPTION**

This unit covers competences required to apply analogue electronics. Competences includes understanding semiconductor theory, applying semiconductor diodes, demonstrating understanding of transistors, applying special semiconductor devices, performing rectification, applying amplifiers, use of oscillators and application of Opto-electronics.

**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. Understand semiconductor theory | * 1. Types of ***materials*** are identified in line with semiconductor theory.   2. Semiconductor materials are identified as per electrical conductivity properties. |
| 1. Apply semiconductor diodes | * 1. Types of diodes are identified as per functionality.   2. ***Diodes*** characteristics are determined as per properties.   3. Forward and reverse bias characteristics are established as per properties of the semiconductor material. |
| 1. Apply transistors | * 1. ***Transistors*** are identified as per characteristics.   2. NPN and PNP are determined as per operation.   3. P and N channels are identified as per operation.   4. ***Biasing*** and determination of gain of transistors is performed as per standard operating procedure.   5. Transistor configuration is performed as per application. |
| 1. Apply special semiconductor devices | * 1. Special semiconductor devices are identified as per operation.   2. Special semiconductors are applied as per standard operating procedure.   3. Types of special semiconductor devices are identified. |
| 1. Perform rectification | * 1. Types of rectifiers are identified as per functions.   2. Classes of rectifiers are identified as per input voltage.   3. Applications of rectifiers are established.   4. Converters are identified as per functions.   5. Applications of converters are established as per functions. |

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

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

* The manufacturer's warranty requirements relating to electronics installation systems and related components.
* The legal requirements relating to electricalinstallations
* Kenyan legislation and workplace procedures relevant to:
* Health and safety;
* Environment (including waste disposal);
* Appropriate personal protective equipment (PPE).
* Work place communication;
* Time management
* 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 and standard operating procedures and health and safety requirements
* Contractual agreements
* Necessary insurance and policies including security bonds, performance bonds, contractors all risks
* Insurance of contractor’s work
* Keeping records of income
* Financial statements

**FOUNDATION SKILLS**

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

**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 as per work procedure. 2. Applied diodes in electronic circuits as per work procedure. 3. Applied transistors in basic electronic circuits as per work procedure. 4. Identified special semiconductor devices as per work procedure. 5. Performed rectification of ac power to dc power as per work procedure. |
| 1. Resource Implications | The following resources must be provided:   * 1. Appropriately simulated environment where assessment can take place.   2. Access to relevant workplace environment.   3. Resources relevant to the proposed activities or tasks. |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Practical test   2. Third Party Report   3. Portfolio of evidence   4. Written test   5. Oral questioning |
| 1. Context of Assessment | Competency may be assessed in actual workplace or simulated workplace. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY DIGITAL ELECTRONICS I

**UNIT CODE: 0714 541 10A**

**UNIT DESCRIPTION**

This unit describes competences required to apply digital electronics. Competences include applying knowledge of number systems, applying knowledge of binary code and applying logic gates and Boolean algebra concepts.

**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 knowledge of number systems | * 1. Number system knowledge is applied as per digital system design.   2. Number systems conversion knowledge is applied as per digital system design.   3. Binary numbers are represented into one’s and two’s complements knowledge is applied as per type of ***arithmetic operations.***   4. Binary arithmetic knowledge is applied as per type of arithmetic operations. |
| 1. Apply knowledge of binary codes | * 1. Binary code concepts knowledge is applied as per digital system design.   2. Decimal numbers are represented in binary coded decimal (BCD) knowledge is applied as per circuit design specifications.   3. Binary numbers are represented in gray codes knowledge is applied as per circuit design specifications.   4. Alphanumeric techniques knowledge is applied as per digital system design.   5. Error detection and correction knowledge is applied as per digital system design. |
| 1. Apply Logic gates and Boolean algebra concepts | * 1. Principles of ***logic gates*** are applied as as per digital system design specifications.   2. logic gates operation knowledge is applied as per type digital system design specifications.   3. Boolean algebra concepts are applied as per digital system design specifications.   4. Logic circuits concepts are applied as per digital system design specifications. |

**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. ***arithmetic operations*** may include but not limited to: | * + Addition (+)   + Subtraction (-)   + Multiplication (x)   + Division (/) |
| 1. ***logic gates*** may include but not limited to: | * + AND Gate   + OR Gate   + NOT Gate   + NAND Gate   + NOR Gate   + XOR Gate (Exclusive OR)   + XNOR Gate (Exclusive NOR or Equivalence) |
| 1. ***Logic families*** may include but not limited to: | Bipolar Families:   * + Diode Logic (DL)   + Resistor Transistor Logic (RTL)   + Diode Transistor Logic (DTL)   + Transistor-Transistor Logic (TTL)   + Emitter Coupled Logic (ECL) or Current Mode Logic (CML)   + Integrated Injection Logic (IIL)   MOS Families:   * + P-MOS Family   + N-MOS Family   + Complementary-MOS Family   Hybrid Family:   * + Bi-CMOS Family |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

* + - * Proficiency in software, efficiency in programming, command of several computer languages, computer-aided drafting tools, and circuit simulators1.
      * Practical experience of different circuits and electrical embedding1.
      * Knowledge of electronic components, circuits, semiconductors, electromechanical machine design, communications systems, and signal systems2.
      * Basic Math.
      * Electrical Safety
      * Electrical Theory
      * Electrical Components
      * Circuit Boards.
      * Circuit Analysis
      * Instrumentation and Electrical Measurements

**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
* Selecting the correct type of electrical machines for various uses
* 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:   * + applied Number systems conversion knowledge as per digital system design.   + applied Number systems conversion knowledge as per digital system design.   + applied knowledge Decimal numbers represented in binary coded decimal (BCD) as per circuit design specifications.   + applied Error detection and correction knowledge as per digital system design.   + applied logic gates operation knowledge as per type digital system design specifications.   + applied Logic circuits concepts as per digital system design specifications. |
| 1. Resource Implications | The following resources must be provided:   * + Access to relevant workplace where assessment can take place.   + Appropriately simulated environment where assessment can take place.   + Materials relevant to the proposed assessment activity or tasks. |
| 1. Methods of Assessment | Competency may be assessed through:   * Observation * Written test * Practical * Demonstration * Oral questioning * Third party report |
| 1. Context of Assessment | Competency may be assessed in a Workplace or Simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY ANALOGUE ELECTRONICS II

**UNIT CODE:** **0714 541 09A**

**UNIT DESCRIPTION**

This unit covers competences required to apply analogue electronics. Competences includes applying amplifiers, use of oscillators and application of opto-electronics.

**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 amplifiers | * 1. Types of ***amplifiers*** are identified as per functions.   2. Operational amplifier is identified as per its applications.   3. Characteristics of operational amplifiers are determined. |
| 1. Use oscillators | * 1. ***Oscillators*** are classified as per operation.   2. Types of oscillators is determined as per applications.   3. Damped and Undamped oscillation is performed as per oscillator operation.   4. Wave shaping and pulse generation circuits are performed as per standard operating procedure |
| 1. Apply opto-electronics | * 1. Types of Opt-electronics semiconductors are identified as per operation characteristics.   2. ***Lasers*** and masers are identified as per operations   3. Drive requirements are determined as per display. |

**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. ***Amplifiers*** may include but not limited to: | * RC coupled amplifiers * Small signal amplifiers * Power amplifiers * Tuned amplifier * Wide band amplifiers * Op-Amp amplifiers |
| 1. ***Oscillators*** may include but not limited to: | * Tuned collector * RC phase shift * Colpits * Hartley * Crystal * Blocking |
| 1. ***Lasers*** may ***i***nclude but not limited to | * Gaseous lasers * Solid lasers |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

* The manufacturer's warranty requirements relating to electronics installation systems and related components.
* The legal requirements relating to electricalinstallations
* Kenyan legislation and workplace procedures relevant to:
* Health and safety;
* Environment (including waste disposal);
* Appropriate personal protective equipment (PPE).
* Work place communication;
* Time management
* 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 and standard operating procedures and health and safety requirements
* Contractual agreements
* Necessary insurance and policies including security bonds, performance bonds, contractors all risks
* Insurance of contractor’s work
* Keeping records of income
* Financial statements

**FOUNDATION SKILLS**

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

**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 operational amplifiers as per application as per work procedure. 2. Used oscillators in wave shaping and pulse generation circuits as per work procedure. 3. Identified various types of opto-electronics semiconductors as per applications and work procedure. |
| 1. Resource Implications | The following resources must be provided:   * 1. Appropriately simulated environment where assessment can take place.   2. Access to relevant workplace environment.   3. Resources relevant to the proposed activities or tasks. |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Practical test   2. Third Party Report   3. Portfolio of evidence   4. Written test   5. Oral questioning |
| 1. Context of Assessment | Competency may be assessed in actual workplace or simulated workplace. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY DIGITAL ELECTRONICS II

**UNIT CODE: 0714 541 10A**

**UNIT DESCRIPTION**

This unit describes competences required to apply digital electronics. Competences include applying knowledge of digital logic circuits, applying knowledge of converters (ADC and DAC) and managing computer memories.

**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 knowledge of digital logic circuits | * 1. combinational logic circuits principles are applied as per type of digital operation.   2. transistor as a switch knowledge is applied as per type of digital operation.   3. ***Logic families*** knowledge is applied as per digital system design specifications.   4. ***flip flops circuits*** conceptsare applied as per type of digital operation.   5. ***combination circuits*** operations knowledge is applied as per type of digital operation. |
| 1. Apply knowledge of advance digital logic and converter circuits | * 1. Principles of operation of shift registers are applied as per digital system design specifications.   2. Manufacture’s datasheets and catalogues knowledge is applied to identify ICs as per work requirement.   3. Operation principles of synchronous and asynchronous counters are applied as per circuit design.   4. Operation of feedback register knowledge is applied as per circuit design.   5. Principles of operations of ***arithmetic logic circuits*** are applied as per type of arithmetic operations.   6. Operational amplifier as a comparator knowledge is applied as per type of digital operation.   7. Operation principles of ***digital converters circuits*** are applied as per digital system requirements. |
| 1. Manage computer memories | * 1. Memory categories knowledge is applied as per system design specifications.   2. ***computer memories o***peration knowledge is applied as per memory design specifications.   3. Memory map and organization knowledge is applied as per system design specifications. |

**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. ***Logic families*** may include but not limited to: | Bipolar Families:   * + Diode Logic (DL)   + Resistor Transistor Logic (RTL)   + Diode Transistor Logic (DTL)   + Transistor-Transistor Logic (TTL)   + Emitter Coupled Logic (ECL) or Current Mode Logic (CML)   + Integrated Injection Logic (IIL)   MOS Families:   * + P-MOS Family   + N-MOS Family   + Complementary-MOS Family   Hybrid Family:   * + Bi-CMOS Family |
| 1. ***Fllip flops*** circuits may include but not limited to: | * + Coulomb’ law   + Gauss law   + Faraday’s laws   + Amperes law   + Lenz’ law |
| 1. ***Combination circuits*** may include but not limited to: | * + SR Flip Flop   + JK Flip Flop   + D Flip Flop   + T Flip Flop |
| 1. ***Arithmetic logic circuits*** may include but not limited to: | * + Adder   + Subtractor   + Multiplier   + Divider   + Incrementer   + Decrementer   + Comparator   + Shifter/Rotator |
| 1. ***Digital converters circuits*** may include but not limited to | * + Analog to Digital Converter (ADC)   + Digital to Analog Converter (DAC) |
| 1. ***Computer memories*** may include but not limited to | * + RAMs   + ROMs   + EEPROMs   + EPROMs |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

* + - * Proficiency in software, efficiency in programming, command of several computer languages, computer-aided drafting tools, and circuit simulators1.
      * Practical experience of different circuits and electrical embedding1.
      * Knowledge of electronic components, circuits, semiconductors, electromechanical machine design, communications systems, and signal systems2.
      * Basic Math.
      * Electrical Safety
      * Electrical Theory
      * Electrical Components
      * Circuit Boards.
      * Circuit Analysis
      * Instrumentation and Electrical Measurements

**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
* Selecting the correct type of electrical machines for various uses
* 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:   * + applied Number systems conversion knowledge as per digital system design.   + applied Number systems conversion knowledge as per digital system design.   + applied knowledge Decimal numbers represented in binary coded decimal (BCD) as per circuit design specifications.   + applied Error detection and correction knowledge as per digital system design.   + applied logic gates operation knowledge as per type digital system design specifications.   + applied Logic circuits concepts as per digital system design specifications.   + Applied ***Logic families*** knowledge as per digital system design specifications.   + Applied ***flip flops circuits*** conceptsas per type of digital operation.   + Applied Manufacture’s datasheets and catalogues knowledge to identify ICs as per work requirement.   + Applied principles of operations of ***arithmetic logic circuits*** as per type of arithmetic operations.   + Applied Operation principles of ***digital converters circuits*** as per digital system requirements.   + Applied ***computer memories o***peration knowledge as per memory design specifications. |
| 1. Resource Implications | The following resources must be provided:   * + Access to relevant workplace where assessment can take place.   + Appropriately simulated environment where assessment can take place.   + Materials relevant to the proposed assessment activity or tasks. |
| 1. Methods of Assessment | Competency may be assessed through:   * Observation * Written test * Practical * Demonstration * Oral questioning * Third party report |
| 1. Context of Assessment | Competency may be assessed in a Workplace or Simulated workplace |
| 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

**INSTALL PVC SHEATHED CABLE SYSTEM**

**UNIT CODE:** **0713 551 23A**

**UNIT DESCRIPTION**

This unit specifies competences required for installing PVC sheathed cable system. The competences include identifying cables and accessories, making cable joints, interpreting electrical symbols and fixing electrical accessories.

**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. Identify cables and accessories | * 1. Safety measures are applied as per OSHA and EHS standards.   2. Electrical cable colour code is identified as per IEC standards.   3. Electrical ***cable sizes*** are identified as per IEC standards   4. ***Electrical accessories*** are identified as per IEC standards. | |
| 1. Make cable joints | * 1. Safety measures are applied as per OSHA and EHS standards.   2. Electrical tools and equipment are selected as per work requirement.   3. ***Electrical cable joints*** are prepared as per IEC standards.   4. ***Housekeeping activities*** are performed as per the work requirement. | |
| 1. Interpret electrical symbols | * 1. Electrical symbols are sketched as per established standards.   2. Wiring diagrams are drawn as per the work requirement   3. Electrical components are identified as per the drawing | |
| 1. Fix electrical accessories | * 1. Safety measures are applied as per OSHA and EHS standards.   2. Electrical single-phase intake point is installed as per IET regulation.   3. ***Electrical final circuits*** are installed as per design requirement.   4. ***Housekeeping activities*** are performed as per the work requirement. | |

**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. Electrical cable joints include but is not limited to: | * Britannia * Married * Tee * Straight twist * Scarf |
| 1. Electrical accessories and fittings include but is not limited to: | * Sockets * Switches * Lamp holders * Junction boxes * Pattress * Couplers * Circuit breakers * Plugs |
| 1. Cable sizes may include but not limited to: | * 1.0mm2 * 1.5 mm2 * 2.5 mm2 * 4.0 mm2 * 6.0 mm2 |
| 1. Electrical final circuits may include but is not limited to: | * Lighting * Power |
| 1. Housekeeping activities may include but not limited to: | * General cleanliness * Tools and equipment storage |

**REQUIRED KNOWLEDGE**

The individual needs to demonstrate knowledge of:

* Units of measurement and abbreviations
* Work sequence
* Electrical materials
* Tools and equipment

**REQUIRED SKILLS**

* Communication skills
* Negotiation skills
* Digital literacy
* Waste disposal
* Occupational safety and health practices

**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 electrical cable colour code as per IEC standards. 2. Identified electrical cable sizes as per IEC standards 3. Identified electrical accessories as per IEC standards 4. Applied safety measures as per OSHA and EHS standards. 5. Selected electrical tools and equipment as per work requirement. 6. Drew Wiring diagrams as per the work requirement 7. Prepared electrical cable joints as per IEC standards. 8. Installed electrical single-phase intake point as per IET regulation. 9. Installed electrical final circuits as per design requirement. |
| 1. Resource Implications | The following resources should be provided:  2.1 Appropriately simulated environment where assessment can take place.  2.2 Access to relevant work environments.  2.3 Resources relevant to the proposed activities or task |
| 1. Methods of Assessment | Competency may be assessed through:  3.1 Practical  3.2 Projects  3.3 Written tests  3.4 Oral questions  3.5 Portfolio of evidence  3.6 Third party evidence |
| 1. Context of Assessment | * + 1. Competency may be assessed in a work place or a simulated work place. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

**INSTALL TRUNKING SYSTEM**

**UNIT CODE:** **0713 551 24A**

**UNIT DESCRIPTION**

This unit covers competences required in installing trunking system. The competences include identifying trunking accessories, preparing trunking work pieces, mounting trunking work pieces and installing electrical cables and accessories.

**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. Identify trunking accessories | * 1. ***Trunking types*** are identified as per IEC standards.   2. ***Trunking sizes*** are identified as per IEC standards.   3. Trunking accessories are identified as per IEC standards |
| 1. Prepare trunking work pieces | * 1. Safety measures are applied as per OSHA and EHS standards   2. ***Electrical tools*** ***and equipment*** are selected as per work requirement   3. Measurements are taken as per work requirement.   4. Trunking work pieces are cut as per the measurements.   5. ***Housekeeping activities*** are performed as per the work requirement. |
| 1. Mount trunking work pieces | * 1. Safety measures are applied as per OSHA and EHS standards.   2. Mounting points are marked out as per IEC standards   3. Trunking work pieces are mounted as per the IEC standards.   4. ***Housekeeping activities*** are performed as per the work requirement. |
| 1. Install electrical cables and accessories | * 1. Safety measures are applied as per OSHA and EHS standards.   2. Electrical cable colour code is identified as per IEC standards.   3. Electrical ***cable sizes*** are identified as per IEC standards.   4. Cables are laid as per the IEC standards.   5. Accessories are fixed as per IEC standards.   6. ***Housekeeping activities*** are performed as per the work requirement. |
| 1. Perform Tests and Inspection | * 1. Visual inspection is performed as per work requirements   2. Continuity test is performed as per IEC standards   3. polarity test is performed as per IEC standards |
| 1. Promote Ethical Work Practices and Values | * 1. Personal management is demonstrated through self-awareness, self-esteem, emotional intelligence, stress management and assertiveness based on scope of work.   2. Policies and guidelines are observed as per the workplace requirement.   3. Self-worth and professionalism is exercised in line with personal goals and organizational policies   4. Code of conduct is observed as per the workplace requirement.   5. Teamwork is applied as per work place rConflicts are resolved between team members in line with organization 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. Trunking types may include but not limited to: | * PVC * Metallic * Galvanized iron |
| 1. Trunking sizes may include but not limited to: | * 16mm x 16mm * 25mm x 16mm * 25mm x 25mm * 40mm x 25mm |
| 1. Electrical tools and equipment may include but is not limited to: | * Cutting tools * Fastening tools * Measuring tools * Marking tools * Measuring instruments |
| 1. Cable sizes may include but not limited to: | * 1.0mm2 * 1.5 mm2 * 2.5 mm2 * 4.0 mm2 * 6.0 mm2 |
| 1. Housekeeping activities may include but not limited to: | * General cleanliness * Tools and equipment storage |

**REQUIRED KNOWLEDGE**

The individual needs to demonstrate knowledge of:

* Units of measurement and abbreviations
* Work sequence
* Electrical materials
* Tools and equipment

**REQUIRED SKILLS**

**•** Communication skills

• Negotiation skills

• Digital literacy

• Waste disposal

• Occupational safety and health practices

**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 trunking types as per IEC standards. 2. Applied safety measures as per OSHA and EHS standards 3. Cut trunking work pieces as per the measurements. 4. Mounted trunking work pieces as per the IEC standards. 5. Laid cables as per the IEC standards. 6. Fixed accessories as per IEC standards. 7. Performed Continuity test as per IEC standards 8. Code of conduct is observed as per the workplace requirement. |
| 1. Resource Implications | The following resources should be provided:  2.1 Appropriately simulated environment where assessment can take place.   * 1. Access to relevant work environments.   2.3 Resources relevant to the proposed activities or task. |
| 1. Methods of Assessment | Competency may be assessed through:   * Practical * Projects * Written tests * Oral questions * Portfolio of evidence * Third party evidence |
| 1. Context of Assessment | Competency may be assessed in a work place or a simulated work place. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

**INSTALL CONDUIT SYSTEM**

**UNIT CODE:** **0713 551 25A**

**UNIT DESCRIPTION**

This unit covers competences required in installing conduit system. The competences include identifying conduit accessories, preparing conduit work pieces, mounting conduit work pieces and installing electrical cables and accessories.

**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. Identify conduit accessories | * 1. ***Conduit types*** are identified as per IEC standards.   2. ***Conduit sizes*** are identified as per IEC standards.   3. Conduit accessories are identified as per IEC standards |
| 1. Prepare conduit work pieces | * 1. Safety measures are applied as per OSHA and EHS standards   2. ***Electrical tools and equipment*** are selected as per work requirement   3. Measurements are taken as per work requirement.   4. Conduit work pieces are cut as per the measurements.   5. ***Housekeeping activities*** are performed as per the work requirement. |
| 1. Mount conduit work pieces | * 1. Safety measures are applied as per OSHA and EHS standards.   2. Mounting points are marked out as per IEC standards.   3. Conduit work pieces are mounted as per the IEC standards.   4. ***Housekeeping activities*** are performed as per the work requirement. |
| 1. Install electrical cables and accessories | * 1. Safety measures are applied as per OSHA and EHS standards.   2. Electrical cable colour code is identified as per IEC standards.   3. Electrical ***cable sizes*** are identified as per IEC standards.   4. Cables are drawn as per the IEC standards.   5. Accessories are fixed as per IEC standards.   6. ***Housekeeping activities*** are performed as per the work requirement. | |
| 1. Perform Tests and Inspection | * 1. Visual inspection is performed as per work requirements   2. Continuity test is performed as per IEC standards   3. Polarity test is performed as per IEC standards | |
| 1. Apply Entrepreneurial Skills | 1. Personal finances are managed as per financial procedures and standards 2. Savings are managed as per financial procedures and standards 3. Sources of personal and business funds are identified as per financial procedures and standards 4. Salaried employment and self-employment are distinguished as per principles of entrepreneurship 5. Requirements for entry into self-employment are identified according to business procedures and standards 6. Regulatory requirements when starting a small business are identified as per business procedures and standards   Business planning is undertaken as per resource implications and regulatory framework | |

**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. Conduit types may include but not limited to: | * Metallic * PVC |
| 1. Conduit sizes may include but not limited to: | * 20mm2 * 25mm2 * 32mm2 |
| 1. Electrical tools and equipment may include but is not limited to: | * Cutting tools * Fastening tools * Measuring tools * Marking tools * Measuring instruments |
| 1. Cable sizes may include but not limited to: | * 1.0mm2 * 1.5 mm2 * 2.5 mm2 * 4.0 mm2 * 6.0 mm2 |
| 1. Housekeeping activities may include but not limited to: | * General cleanliness * Tools and equipment storage |

**REQUIRED KNOWLEDGE**

* The individual needs to demonstrate knowledge of:
* Units of measurement and abbreviations
* Work sequence
* Electrical materials
* Tools and equipment

**REQUIRED SKILLS**

• Communication skills

• Negotiation skills

• Digital literacy

• Waste disposal

• Occupational safety and health practices

**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 conduit types as per IEC standards. 2. Identified conduit accessories as per IEC standards. 3. Applied safety measures as per OSHA and EHS standards. 4. Cut conduit work pieces as per the measurement. 5. Mounted conduit work pieces as per the IEC standards. 6. Drawn cables as per the IEC standards. 7. Fixed accessories as per IEC standards 8. Performed Continuity test as per IEC standards 9. Identified Sources of personal and business funds as per financial procedures and standards |
| 1. Resource Implications | The following resources should be provided:   1. Appropriately simulated environment where assessment can take place. 2. Access to relevant work environments. 3. Resources relevant to the proposed activities or task |
| 1. Methods of Assessment | Competency may be assessed through:  3.1 Practical  3.2 Projects  3.3 Written tests  3.4 Oral questions  3.5 Portfolio of evidence  3.6 Third party evidence |
| 1. Context of Assessment | Competency may be assessed in a work place or a simulated work place. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

**INSTALL** **STAND-ALONE SOLAR PV SYSTEMS**

**UNIT CODE:** 0713 351 26A

**UNIT DESCRIPTION**

This unit covers competences required in installing stand-alone solar PV system. Competences include Applying basic electrical concepts, interpreting stand-alone solar PV Installation drawings, installing stand-alone Solar PV components, installing electrical wiring system, testing stand-alone solar PV system 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 basic electrical concepts | | * 1. Basic SI units in Electrical are identified based on scope of work.   2. Quantities of Charge, force, work and power are identified as per IEC standards.   3. Calculations involving Ohm’s law i.e. Current, Resistance and voltage are performed as per IEC standards.   4. Calculations involving various electrical quantities are performed based on IEC standards. | |
| 1. Interpret stand-alone Solar PV Installation drawings | | * 1. Electrical symbols are identified as per IEC standards.   2. Wiring system is mapped as per design.   3. Final circuits drawing is interpreted as per design requirement. | |
| 1. Install stand-alone Solar PV Components | | * 1. Safety measures are applied as per work requirement.   2. Electrical tools and equipment are selected as per work requirement.   3. ***Solar PV system components*** are identified as per design requirement.   4. Solar PV system components are mounted as per design requirement. | |
| 1. Install electrical wiring system | | 1. ***Electrical cable joints*** and termination are prepared as per design requirement. 2. ***Electrical accessories and fittings*** are identified as per design requirement. 3. ***Cable management systems*** are installed as per design requirement. 4. ***Electrical final circuits*** are installed as per design requirement. 5. Solar PV system components are terminated as per design requirement. | |
| 1. Test stand-alone solar PV system installation | | 1. Solar PV system conditions are visually inspected as per IET regulations. 2. Continuity test is carried out as per IET regulation. 3. Insulation resistance test is carried out as per IET regulations. 4. Polarity test is carried out as per IET regulations. 5. Earth resistance tests are carried out as per IET regulations. | |
| 1. Maintain stand-alone Solar PV system | | 1. Solar PV system is inspected as per IET regulations. 2. Maintenance materials and tools are prepared as per the maintenance strategy requirement. 3. ***Solar pv system maintenance activities*** are carried out as per IEC standards. 4. Solar PV system tests are carried out as per IEC standards. 5. Maintenance records are updated as per maintenance strategy. | |

**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. ***Solar PV system components*** may include but not limited to: | * PV module * Charge controller * Solar batteries * Solar inverters |
| 1. ***Electrical cable joints*** may include but not limited to: | * Britannia * Married * Tee * Straight twist * scarf |
| 1. **Electrical accessories and fittings** may include but not limited to: | * Sockets * Switches * Lamp holders * Junction boxes * Pattress * Couplers * Circuit breakers * Plugs |
| 1. ***Cable management systems*** may include but not limited to: | * Cable trays * Cable duct * Bus-bars * Sheath/surface * Conduits * Trunking |
| 1. ***Electrical final circuits*** may include but not limited to: | * Lighting * Power |
| 1. ***Solar pv system maintenance activities*** may include but not limited to | * Cleaning * Topping up batteries * Loose connections |

**REQUIRED KNOWLEDGE**

The individual needs to demonstrate knowledge of:

* Technical drawing
* Numeracy skills
* Workshop technology
* IEE regulations
* Electrical Technology
* Renewable energy
* Building codes

**FOUNDATION SKILLS**

* Communication skills
* Digital literacy
* Entrepreneurial skills
* Employability skills
* Environmental literacy
* Occupational safety and health practices
* Interpret electrical drawing
* Identification and proper use of electrical tools

**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. Performed Calculations involving various electrical quantities based on IEC standards. 2. Interpreted final circuits drawing as per design. 3. Applied Safety measures as per work requirement. 4. Mounted solar PV system components as per design requirement. 5. Installed Cable management system as per design requirement. 6. InstalledElectrical final circuitsas per design requirement. 7. Terminated solar PV system components as per design requirement. 8. Installed Earthing and protection systems as per acceptable standards. 9. Carried out electrical installation testing as per IET regulations. 10. Carried out Maintenance activities as per IET regulations. |
| 1. Resource Implications | The following resources should be provided:  2.1 Appropriately simulated environment where assessment can take place.  2.2 Access to relevant work environments.  2.3 Resources relevant to the proposed activities or task |
| 1. Methods of Assessment | Competency may be assessed through:   * Practical demonstration * Projects * Written tests * Oral test |
| 1. Context of Assessment | Competency may be assessed in a work place or a simulated work place. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

**PERFORM BELL AND ALARM INSTALLATION**

**UNIT CODE:** 0713 351 27A

**UNIT DESCRIPTION**

This unit covers the competencies required in perform bell and alarm installation. Competencies include interpreting bell and alarm installation drawings, installing bell and alarm wiring system, installing bell and alarm components, testing bell and alarm installation and maintaining bell and alarm 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. Interpret Bell and alarm Installation drawings | | 1. Bell and alarm symbols are identified as per IEC standards. 2. Wiring system is mapped as per design. 3. Bell and alarm circuits drawing is interpreted as per design requirement. |
| 1. Install bell and alarm wiring system | | * 1. Safety measures are applied as per work requirements.   2. Electrical tools and equipment are selected as per work requirement.   3. ***Electrical cable joints*** and termination are prepared as per design requirement.   4. ***Bell and alarm accessories and fittings*** are identified as per design requirement.   5. ***Cable management system*** is installed as per design requirement.   6. Bell and alarm systems are installed as per design requirement. |
| 1. Install Bell and Alarm Components | | 1. ***Bell and alarm components*** are identified as per design requirement. 2. Electrical power supply is installed as per design requirement. 3. Bell and alarm components are installed as per design requirement. |
| 1. Test Bell and Alarm installation | | * 1. Bell and alarm system conditions are visually inspected as per IET regulations.   2. Continuity test is carried out as per IET regulation.   3. Insulation resistance test is carried out as per IET regulations.   4. Polarity test is carried out as per IET regulations.   5. Earth resistance tests are carried out as per IET regulations. | |
| 1. Maintain Bell and Alarm installation | | * 1. Bell and alarm systems are inspected as per IET regulations.   2. Maintenance materials and tools are prepared as per the maintenance strategy requirement.   3. ***Bell and alarm system Maintenance activities*** are carried out as per IET regulations.   4. System tests are carried out as per IET regulations.   5. Maintenance records are updated as per maintenance strategy. | |

**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. ***Electrical cable joints*** may include but not limited to: | * Britannia * Married * Tee * Straight twist * scarf |
| 1. ***Bell and alarm components*** may include but not limited to: | * Bell transformers * Indicator board * Bell bushes * Bell relays * Control panel * Sounders * Buzzers * Bell * Hooters * Sirens |
| 1. ***Bell and alarm accessories and fittings*** may include but not limited to: | * Switches * Junction boxes * Pattress * Couplers * Circuit breakers * Plugs |
| 1. ***Cable management systems*** may include but not limited to: | * Cable trays * Cable duct * Bus-bars * Sheath/surface * Conduits * Trunking |
| 1. ***Bell and alarm system Maintenance activities*** may include but not limited to: | * Cleaning * Loose connections |

**REQUIRED KNOWLEDGE**

The individual needs to demonstrate knowledge of:

* Technical drawing
* Numeracy skills
* Workshop technology
* IEE regulations
* Electrical Technology
* Renewable energy
* Building codes

**FOUNDATION SKILLS**

* Communication skills
* Digital literacy
* Entrepreneurial skills
* Employability skills
* Environmental literacy
* Occupational safety and health practices
* Interpret electrical drawing
* Identification and proper use of electrical tools

**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. Interpreted Bell and alarm circuits drawing as per design requirement 2. Applied safety measures as per work requirement. 3. Installed cable management system as per design requirement. 4. Identified bell and alarm components as per design requirement. 5. Installed bell and alarm systemsas per design requirement. 6. Installed electrical power supply as per design requirement. 7. Installed bell and alarm componentsas per design requirement. 8. Carried out electrical installation testing as per IET regulations. 9. Carried out Maintenance activities as per IET regulations. |
| 1. Resource Implications | The following resources should be provided:  2.1 Appropriately simulated environment where assessment can take place.  2.2 Access to relevant work environments.  2.3 Resources relevant to the proposed activities or task |
| 1. Methods of Assessment | Competency may be assessed through:   1. Practical demonstration 2. Projects 3. Written tests 4. Oral test |
| 1. Context of Assessment | Competency may be assessed in a work place or a simulated work place. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## PERFORM ELECTRICAL INSTALLATION

**UNIT CODE:** **0713 451 10A**

**UNIT DESCRIPTION**

This unit specifies competences required for performing electrical installation. Competences include conducting site survey, preparing electrical drawings, performing installation system sizing, installing electrical system, performing electrical installation testing, performing electrical installation maintenance and commissioning electrical 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. Conduct site survey | | 1. Health and Safety Procedures are adhered to as per work requirement. 2. Client needs are gathered as per organization requirements. 3. Site condition is assessed according to the established procedures. 4. Installation route is identified as per the standard operating procedure. 5. Survey report is prepared according to the established procedures. 6. Site survey report is shared with relevant parties as per organization procedures. | |
| 1. Prepare electrical drawings | | 1. Electrical symbols are applied as per ***established standards.*** 2. ***Wiring system*** is selected as per client’s need and site condition. 3. Final circuits concept/preliminary drawing is prepared as per client requirement and electrical convention standards. 4. Electrical drawing is submitted for approval as per organization procedures. | |
| 1. Perform installation system sizing | | 1. Load is estimated as per client requirements. 2. Protective devices are determined as per IET regulations. 3. Cable sizes are calculated according to IET regulations. 4. Accessories ratings are identified as per IET regulations. 5. Phase balancing is determined as per load requirement. 6. Working drawing is prepared as per the design. 7. BOQ is prepared according to the design. 8. Contract documents are prepared as per organization requirements | |
| 1. Install electrical system | | 1. Health and Safety Procedures are adhered to as per work requirement. 2. Tools, equipment and materials are acquired as per work plan. 3. ***Cable management systems*** are installed as per work requirement***.*** 4. Earthing and protection systems are installed as per work requirement***.*** 5. Cables and conductors are installed as per work requirement***.*** 6. Cable lugging, glanding and termination is performed as per work requirement***.*** 7. Cables are labelled as per IET standards. 8. Accessories are installed as per working drawing and IET regulations. 9. Deviations are captured in as built drawing and shared with relevant parties. 10. ***Housekeeping practices*** are performed according to EHS and OSHA. | |
| 1. Perform electrical installation testing | | * 1. ***Visual inspection*** is conducted per IET regulations.   2. Firmness of the installation is confirmed.   3. Continuity test is performed as per IET regulation   4. Insulation resistance test is carried out as per IET regulations.   5. Polarity test is carried out as per IET regulations.   6. Earth resistance tests are carried out as per IET regulations.   7. Earth loop impedance tests are carried out as per IET regulations. | |
| 1. Perform electrical installation maintenance | | * 1. ***Maintenance strategy*** is developedas persystem functionality.   2. Maintenance schedule is prepared as per organization procedures.   3. Electrical equipment and system are inspected as per IET regulations.   4. Maintenance materials and tools are prepared as per the maintenance strategy requirement.   5. Maintenance activities are carried out as per IET regulations.   6. System tests are carried out as per IET regulations.   7. Maintenance records are updated as per maintenance strategy. | |
| 1. Commission electrical installation | | 1. ***Commissioning panel*** is constituted as per the project requirement. 2. ***Commissioning program*** is developed as per the project requirement. 3. Safety procedures are adhered to as per OSHA standards. 4. Functionality tests are carried out as per IET regulations. 5. ***Commissioning documents*** are prepared and shared with the relevant parties. 6. End-user is trained as per electrical system 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. ***Established standards*** may include but not limited to: | * IEC Standards * IET regulations * IEEE standards |
| 1. ***Wiring system*** may include but not limited to: | * Sheath/surface * Conduits * Trunking * Duct |
| 1. ***Cable management systems*** may include but not limited to: | * Cable trays * Cable duct * Bus-bars |
| 1. ***Design*** may include but not limited to: | * Illumination * Generation of load schedule |
| 1. ***Housekeeping practices*** may include but not limited to: | * Disposal of waste * Cleaning * Tools storage * Reusing and recycling |
| 1. ***Visual inspection*** may include but not limited to: | * Color codes * Labelling * Termination |
| 1. ***Maintenance strategy*** may include but not limited to: | * Preventive/pro active * Breakdown/corrective/reactive * Scheduled |
| 1. ***Commissioning panel*** may include but not limited to: | * Client * Project managers * Technical engineer * Contractor * Other stakeholders e.g. supply authority |
| 1. ***Commissioning program*** may include but not limited to: | * Pre- commissioning inspection * Off load commissioning test program * Pre-energization inspection * Post commissioning program |
| 1. ***Commissioning documents*** may include but not limited to: | * Management activities * Test reports * Commissioning report |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

The individual needs to demonstrate knowledge and understanding of:

1. The legal requirements relating to activities for electrical power lines installations and components.
2. Legislation and workplace procedures relevant to:

* Environment, health and safety;
* Appropriate PPE (personal protective Equipment)

1. Observe Country Government bylaws
   * + EPRA (Energy & Petroleum Regulatory Authority)
     + NEMA
     + KPLC Electrical Safety rules
2. The importance of documenting electrical systems installation information
3. The importance of working to agreed timelines
4. How to prepare, interpret and use sources of technical information for scheduled Electrical power lines construction works
5. The importance of using the correct sources of technical information.
6. The purpose of and how to use identification codes (e.g., colour codes).
7. Power system operation
8. The operating specifications and tolerances for different types of power systems components
9. The hazards associated with operating construction and operation of a power system.
10. Identification of users to be trained

**FOUNDATION SKILLS**

1. Communications (verbal and written);
2. Proficient in ICT;
3. Time management;
4. Problem solving;
5. Negotiation
6. Decision making;
7. First aid;
8. Report writing;
9. Planning;

**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 health and safety procedures as per work requirement. 2. Assessed site condition according to the established procedures. 3. Prepared survey report according to the established procedures. 4. Applied electrical symbols as per established standards. 5. Selected wiring system as per client’s need and site condition. 6. Estimated load as per client requirements. 7. Determined protective devices as per IET regulations. 8. Identified accessories ratings as per IET regulations. 9. Prepared Working drawing as per the design. 10. Installed Earthing and protection systems as per acceptable standards. 11. Installed cables and conductors as per acceptable standards. 12. Performed electrical installation testing as per IEC standards. 13. Developed Maintenance strategy as per system functionality. 14. Carried out Maintenance activities as per IET regulations. 15. Developed Commissioning program as per the project requirement. 16. Prepared Commissioning documents and shared with the relevant parties. |
| 1. Resource Implications | The following resources should be provided:  2.1 Appropriately simulated environment where assessment can take place.  2.2 Access to relevant work environments.  2.3 Resources relevant to the proposed activities or task. |
| 1. Methods of Assessment | Competency may be assessed through:   1. Practical 2. Projects 3. Third party report 4. Portfolio of evidence 5. Written tests 6. Oral questioning |
| 1. Context of Assessment | * + 1. Competency may be assessed in a work place or a simulated work place. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

**PERFORM ELECTRICAL MACHINE INSTALLATION**

**UNIT CODE:** **0713 451 12A**

**UNIT DESCRIPTION**

This unit covers competences required in performing electrical machine installation. Competences include conducting site survey, installing electrical machine, testing electrical machine installation, maintaining electrical machine installation, and commissioning electrical machine installations.

**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. Conduct site survey | | * 1. Health and Safety Procedures are adhered to as per work requirement.   2. ***Security issues*** are identified as per environment.   3. ***Utility services*** are identified as per existing design.   4. Work plan is prepared in accordance with regulatory requirements and organization procedures.   5. Machine installation layout is prepared as per site.   6. ***Cable management system*** is established as per IET regulations.   7. BOQ is prepared as per design.   8. Site survey report is prepared and shared with relevant parties according to the established procedures. | |
| 1. Install electrical machine | | * 1. Safety procedures are adhered to as per work requirement.   2. Materials, tools and equipment are assembled as per scope of installation.   3. Electrical machine support is constructed/set up as per design.   4. Mounting of the machine is carried out as per load, size and functionality.   5. ***Control gear*** is installed as per machine design.   6. Conduits, trunks, enclosures and support systems are installed as per layout diagram and IET regulations.   7. Cables and conductors are installed as per acceptable standards.   8. Cable lugging, glanding and termination is performed as per acceptable standards.   9. Cables are labelled as per IET standards.   10. ***Housekeeping practices*** are performed according to EHS and OSHA. | |
| 1. Test electrical machine installation | | * 1. Type of tests are identified as per IET regulations.   2. Visual inspection is carried out as per IET regulations.   3. Firmness of the installation is verified as per IET regulations.   4. Insulation resistance test is carried out as per IET regulations.   5. Continuity test is carried out as per IET regulations.   6. Earthling tests are carried out as per IET regulations.   7. On load and off load tests are carried out as per the manufacturer’s manual.   8. Test results are documented as per workplace requirements. | |
| 1. Maintain electrical machine installation | | * 1. ***Maintenance schedule*** is prepared as per OEMS and organization procedures.   2. System maintenance check list is prepared as per tasks and manufacturer’s manual.   3. Maintenance tools and equipment are selected as per scheduled maintenance.   4. Inspection and tests are carried out as per OEMS.   5. Faults are diagnosed as per service manual.   6. Faults are rectified as per service manual.   7. Maintenance report is prepared as per organization requirements***.*** | | |
| 1. Commission electrical machine installation | | * 1. End-user is trained as per system design functionality.   2. Operating manuals are handed over to the end user.   3. Report is prepared and shared with relevant parties.   4. Certificates are issued as per the national 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. ***Security issues*** may include but not limited to: | * Theft * Vandalism |
| 1. ***Utility services*** may include but not limited to: | * Electricity * Water * Road |
| 1. ***Cable management systems*** may include but not limited to: | * Cable trays * Cable ducts * Busbars |
| 1. ***Control gear*** may include but not limited to: | * DOL * Star delta * Forward reverse * Disconnect switches * Circuit breaker |
| 1. ***Housekeeping practices*** may include but not limited to: | * Disposal of waste * Cleaning * Tools storage * Reusing and recycling |
| 1. ***Maintenance schedule*** may include but not limited to: | * Preventive/pro active * Breakdown/corrective/reactive * Scheduled |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

The individual needs to demonstrate knowledge and understanding of:

1. The manufacturer's warranty requirements relating to installation of automation systems related components.
2. The legal requirements relating to commissioning activities for electrical installation systems and components.
3. Legislation and workplace procedures relevant to:

* Environment, health and safety;
* Appropriate PPE (personal protective Equipment)

1. County Government bylaws
   * + EPRA (Energy & Petroleum Regulatory Authority)
     + NEMA
     + CA
2. The importance of documenting automation system installation information
3. The importance of working to agreed timelines
4. How to prepare, interpret and use sources of technical information for scheduled automation system installation activities
5. The importance of using the correct sources of technical information.
6. The purpose of and how to use identification codes (e.g., colour codes).
7. The operating specifications and tolerances for different types of installed systems
8. The hazards associated with operating the system.
9. Identification of users to be trained

**FOUNDATION SKILLS**

The individual needs to demonstrate the following additional 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 skills and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   1. Adhered Health and Safety Procedures as per work requirement. 2. Prepared Machine installation layout as per site. 3. Established Cable management system as per IET regulations. 4. Constructed Electrical machine support as per design. 5. Carried out Mounting of the machine as per load, size and functionality. 6. Installed Control gear as per machine design. 7. Installed Cables and conductors as per acceptable standards. 8. Tested electrical machine installation. 9. Prepared and shared report with relevant parties. 10. Prepared Maintenance schedule as per OEMS and organization procedures. 11. Diagnosed Faults as per service manual. 12. Rectified Faults as per service manual. |
| 1. Resource Implications | The following resources should be provided:  2.1 Appropriately simulated environment where assessment can take place.  2.2 Access to relevant work environments.  2.3 Resources relevant to the proposed activities or task. |
| 1. Methods of Assessment | Competency may be assessed through:   1. Practical 2. Projects 3. Third party report 4. Portfolio of evidence 5. Written tests 6. Oral questioning |
| 1. Context of Assessment | Competency may be assessed in a work place or a simulated work place. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## PERFORM SECURITY SYSTEM INSTALLATION

**UNIT CODE:** **0714 451 33A**

**UNIT DESCRIPTION**

This unit covers competences required in performing security system installation**.** Competences include applying health and safety measures, installing security systems, testing security system installation and maintaining security system installations.

**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 health and safety measures | | 1. PPE are applied as per work requirement. 2. Workshop safety rules are applied as per work procedure. 3. First Aid is carried out as per work procedure. 4. Workshop safety hazards are prevented as per work procedure. 5. Workshop safety risk assessment is conducted as per work procedure. 6. Fire drills are carried out as per workplace procedure. | |
| 1. Install security Systems | | 1. Health and Safety Procedures are adhered as per work requirement. 2. List of materials, tools and equipment is prepared as per design. 3. Work site is prepared for accessibility of utilities. 4. Marking points and zones are identified as per design parameters. 5. Cables are laid and segregated as per IET regulations. 6. ***Security system components*** are installed as per design. 7. Security system is coded as per system functionality. 8. Cables are labelled as per the IET regulations. 9. Housekeeping practices are performed according to EHS and OSHA. | |
| 1. Test security system installation | | 1. Visual inspection is carried out as per the design. 2. Continuity test is carried out as per the design. 3. Polarity test is carried out as per the design. 4. Functionality test is carried out as per the design. 5. Test results are documented as per workplace requirements. | | |
| 1. Maintain security system installation | | 1. Maintenance schedule is prepared as per OEMS and organization procedures. 2. System maintenance check list is prepared as per tasks and manufacturer’s manual. 3. Maintenance tools and equipment are selected as per scheduled maintenance. 4. Inspection and tests are carried out as per OEMS. 5. Faults are diagnosed as per service manual. 6. Faults are rectified as per service manual. 7. Maintenance report is prepared as per organization requirements. | | |

**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. ***Security system*** may include but not limited to: | * CCTV (Burglar alarm) * Fire alarm * Electric fence |
| 1. ***Utility services*** may include but not limited to: | * Water * Electricity * Roads |
| 1. ***Security system components*** may include but not limited to: | * Control panel * Siren * Bell * CCTV * Sensors |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

The individual needs to demonstrate knowledge and understanding of:

1. The manufacturer's warranty requirements relating to installation of automation systems related components.
2. The legal requirements relating to commissioning activities for electrical installation systems and components.
3. Legislation and workplace procedures relevant to:

* Environment, health and safety;
* Appropriate PPE (personal protective Equipment)

1. County Government bylaws
   * + EPRA (Energy & Petroleum Regulatory Authority)
     + NEMA
     + CA
2. The importance of documenting automation system installation information
3. The importance of working to agreed timelines
4. How to prepare, interpret and use sources of technical information for scheduled automation system installation activities
5. The importance of using the correct sources of technical information.
6. The purpose of and how to use identification codes (e.g., colour codes).
7. The operating specifications and tolerances for different types of installed systems
8. The hazards associated with operating the system.
9. Identification of users to be trained

**FOUNDATION SKILLS**

The individual needs to demonstrate the following additional 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 skills and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   1. Prevented Workshop safety hazards as per work procedure 2. Prepared List of materials, tools and equipment as per design. 3. Installed***Security system components*** as per design. 4. Coded Security system as per system functionality 5. Carried out functionality test as per the design |
| 1. Resource Implications include but not limited to | The following resources should be provided:  2.1 Appropriately simulated environment where assessment can take place.  2.2 Access to relevant work environments.  2.3 Resources relevant to the proposed activities or task. |
| 1. Methods of Assessment | Competency may be assessed through:   1. Practical 2. Projects 3. Third party report 4. Portfolio of evidence 5. Written tests 6. Oral questioning |
| 1. Context of Assessment | Competency may be assessed in a work place or a simulated work place. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## INSTALL ELECTRICAL POWER LINES

**UNIT CODE:** **0713 451 31A**

**UNIT DESCRIPTION**

This unit covers competences required in installing power system. Competences include conducting site survey, constructing electrical power lines, testing electrical power line and maintaining electrical power lines.

**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. Conduct site survey | | * 1. Health and Safety Procedures are adhered to as per work requirement.   2. Site conditions are assessed as per mapped location.   3. Tools and equipment are identified as per site condition.   4. ***Power line elements*** are identified as per the drawing.   5. Pole points are marked on the ground as per the drawing. | |
| 1. Construct electrical power lines | | * 1. Health and Safety Procedures are adhered to as per work requirement.   2. ***Power line supports*** are erected as per IEC standards.   3. Line fittings are mounted as per design   4. Line protection devices are installed as per design   5. Power line conductors are mounted as per design   6. Line terminations are carried out as per IEC standards   7. Earthing is carried out as per design.   8. Housekeeping practices are performed according to EHS and OSHA | |
| 1. Test electrical power lines | | * 1. Power line conditions are visually inspected as per IET regulations.   2. ***Line integrity*** is verified as per design specifications.   3. Earth resistance tests are conducted as per IET regulations | |
| 1. Maintain electrical power lines | | * 1. Maintenance scheduleis preparedas persystem requirement.   2. Electrical equipment and system is inspected as per IET regulations.   3. Maintenance materials and tools are prepared as per the maintenance strategy requirement.   4. Maintenance activities are carried out as per IET regulations.   5. Electrical power line tests are carried out as per IET regulations.   6. Maintenance records are updated as per maintenance strategy | |

**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. ***Power line elements*** may include but not limited to: | * Conductors * Insulators * Line supports * Cross arms * D-iron * Damper * Bolt and nuts |
| 1. ***Power line supports*** may include but not limited to: | * Wooden poles * Concrete (RRC) * Steel |
| 1. ***Line integrity*** may include but not limited to: | * Tension * Sag * Span size * Clearance/wayleave requirements |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

The individual needs to demonstrate knowledge and understanding of:-

1. The legal requirements relating to activities for electrical power lines installations and components.
2. Legislation and workplace procedures relevant to:

* Environment, health and safety;
* Appropriate PPE (personal protective Equipment)

1. Observe Country Government bylaws
   * + EPRA (Energy & Petroleum Regulatory Authority)
     + NEMA
     + KPLC Electrical Safety rules
2. The importance of documenting electrical power line installation information
3. The importance of working to agreed timelines
4. How to prepare, interpret and use sources of technical information for scheduled Electrical power lines construction works
5. The importance of using the correct sources of technical information.
6. The purpose of and how to use identification codes (e.g., colour codes).
7. The operating specifications and tolerances for different types of power line construction components
8. The hazards associated with operating construction and operation of power line.
9. Identification of users to be trained

**FOUNDATION SKILLS**

The individual needs to demonstrate the following additional 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 skills and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Adhered to Health and Safety Procedures as per work requirement.   2. Assessed site conditions as per mapped location.   3. Erected Power line supports are as per IEC standards.   4. Mounted line elements as per design.   5. Installed Line protection devices as per design.   6. Carried out Earthing as per design.   7. Tested electrical power lines.   8. Prepared maintenance schedule as per system requirement.   9. Carried maintenance activity as per IET regulations.   10. Updated records as per maintenance strategy. |
| 1. Resource Implications | The following resources should be provided:  2.1 Appropriately simulated environment where assessment can take place.  2.2 Access to relevant work environments.  2.3 Resources relevant to the proposed activities or task. |
| 1. Methods of Assessment | Competency may be assessed through:   * Practical demonstration * Projects * Written test |
| 1. Context of Assessment | Competency may be assessed in a work place or a simulated work place. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |