

**REPUBLIC OF KENYA**

**COMPETENCY BASED CURRICULUM**

**FOR**

**ELECTRONICS TECHNOLOGY**

**KNQF LEVEL 4**

**PROGRAMME ISCED CODE: 0714 354B**

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**FOREWORD**

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

Reforms in the education sector are necessary to achieve Kenya Vision 2030 and meet the provisions of the Constitution of Kenya 2010. The education sector had to be aligned to the Constitution, and this resulted in the formulation of the Policy Framework for Reforming Education and Training in Kenya (Sessional Paper No. 14 of 2012). A key feature of this policy is the radical change in the design and delivery of 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 the mode of delivery allow for multiple entry and exit in TVET programmes.

These reforms demand that Industry takes a leading role in curriculum development to ensure the curriculum addresses its competence needs. It is against this background that this curriculum has been developed. For trainees to build their skills on foundational hands-on activities of the occupation, units of learning are grouped in modules. This has eliminated duplication of content and streamlined exemptions based on skills acquired as a trainee progresses in the up-skilling process, while at the same time allowing trainees to be employable in the shortest time possible through the acquisition of part qualifications.

It is my conviction that this curriculum will play a great role in developing competent human resources for the ………………… Sector’s growth and development.

**PRINCIPAL SECRETARY**

**STATE DEPARTMENT FOR TVET**

**MINISTRY OF EDUCATION**

**PREFACE**

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

TVET Act, CAP 210A and Sessional Paper No. 1 of 2019 on Reforming Education and Training in Kenya for Sustainable Development emphasized the need to reform curriculum development, assessment, and certification. This called for a shift to CBET to address the mismatch between skills acquired through training and skills needed by industry, as well as increase the global competitiveness of the Kenyan labour force.

This curriculum has been developed in adherence to the Kenya National Qualifications Framework and CBETA standards and guidelines. The curriculum is designed and organized into Units of Learning with Learning Outcomes, suggested delivery methods, learning resources, and methods of assessing the trainee’s achievement. In addition, the units of learning have been grouped in modules to concretize the skills acquisition process and streamline upskilling.

I am grateful to all expert trainers and everyone who played a role in translating the Occupational Standards into this competency-based modular curriculum.

**ACKNOWLEDGEMENT**

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

I recognize with appreciation the role of the ………….. National Sector Skills Committee (NSSC) in ensuring that competencies required by the industry are addressed in the curriculum. I also thank all stakeholders in the ………….. sector for their valuable input and everyone who participated in developing this curriculum.

I am convinced that this curriculum will go a long way in ensuring that individuals aspiring to work in the ……………… Sector acquire competencies to perform their work more efficiently and effectively.

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**ABBREVIATIONS AND ACRONYMNS**

A Control Version

BC Basic Competencies

CC Common Competencies

CDACC Curriculum Development, Assessment and Certification Council

CR Core Competencies

CU Curriculum

EE Electronics Engineering

EHS Environment, Health and Safety

ENG Engineering

ET Electronics Technician

IBMS Integrated Building Management System

IEE Institute of Electrical Engineers

KEBS Kenya Bureau of Standards

OS Occupational Standards

OSHA Occupational Safety and Health Act

PPE Personal Protective Equipment

TVET Technical and Vocational Education and Training

WIBA Work injury benefits Act

**KEY TO UNIT CODE**



# COURSE OVERVIEW

This Electronics Level 4 curriculum consists of competencies required to perform electrical installation, install power supply systems, apply electrical instrumentation and maintain Electrical and Electronic Equipment and Appliance.

Electronics Level 4 qualification comprises of the following core units:

**Core Units of Learning**

**Module 1**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit Factor** |
| 0713 251 16A | Electrical installation I | 80 | 8.0 |
| 0713 251 17A | Electrical and Electronics Equipment and Appliances repairs | 80 | 8.0 |
| 0713 251 18A | Electrical instrumentation | 80 | 8.0 |
|  | **Sub Total** | **240** | **24** |

**Module 2**

|  |  |  |  |
| --- | --- | --- | --- |
| 0713 351 19A | Electrical Installation II | 90 | 9 |
| 0713 351 20A | Power Supply System | 70 | 7 |
| 0713 351 21A | Electrical and Electronic Equipment and Appliances Maintenance | 70 | 7 |
|  | Industrial Attachment | 320 | 32 |
| **Sub Total** | | **550** | **55** |
| **Grand Total** | | **790** | **79** |

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

**Entry Requirements**

An individual entering this course should have any of the following minimum requirements:

1. Kenya Certificate of Secondary Education or
2. Electronics Technology Level 3
3. Equivalent qualifications as determined by TVETA

**Trainer Qualification**

Qualifications of a trainer for this course include:

1. Possession of a higher qualification than Electronics technology level 5 or in related trade area; and
2. License by TVETA.
3. License by KETRB/EBK

**Industrial Attachment**

An individual enrolled in this course will be required to undergo Industrial attachment for a minimum period of 320 hours in an Electronics Technology sector.

**Assessment**

The course shall be assessed formatively and summatively:

1. During formative assessment all performance criteria shall be assessed based on performance criteria weighting.
2. Number of formative assessments shall minimally be equal to the number of elements in a unit of competency
3. Assessment of basic and common competencies shall be integrated in the core units
4. Theoretical assessment shall be integrated in practical assessment and conducted orally in both formative and summative assessments.
5. Theoretical and practical weight shall be 10:90 respectively for each unit of learning.
6. Formative and summative assessments shall be weighted at 60% and 40% respectively in the overall unit of learning score
7. For a candidate to be declared competent in a unit of competency, the candidate must meet the following conditions:
8. Obtained at least 40% in theory assessment in formative and summative assessments.
9. Obtained at least 50% in practical assessment in formative and summative assessment where applicable.
10. Obtained at least 50% in the weighted results between formative assessment and summative assessment where the former constitutes 60% and the latter 40% of the overall score.
11. Assessment performance rating for each unit of competency shall be as follows:

|  |  |
| --- | --- |
| **MARKS** | **COMPETENCE RATING** |
| 80 -100 | Mastery |
| 65 - 79 | Proficiency |
| 50 - 64 | Competent |
| 49 and below | Not Yet Competent |
| Y | Assessment Malpractice/irregularities |

1. Assessment for Recognition of Prior Learning (RPL) may lead to award of Part and/or full qualification.

**Certification**

An individual will be awarded a Certificate of Competency on demonstration of competence in a core unit of competency. To be awarded Kenya National TVET Certificate in Electronics level 3, an individual must demonstrate competence in all the units of competency in this qualification pack.

These certificates will be issued by ……..QAI

# MODULE 1

## ELECTRICAL INSTALLATION I

**UNIT CODE:** 0713 251 16A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Perform Electrical Installation

**Duration of Unit: 80** hours

**Unit Description**

This unit specifies the competencies required for performing electrical installation. Competencies required includes, preparation of list of tools equipment and materials, performing piping and laying cables, performing mounting of electrical components and terminating electrical installation.

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/NO** | **Learning Outcome** | **Duration (Hours)** |
|  | Prepare list of tools, equipment and materials | 10 |
|  | Perform piping and laying of cables | 20 |
|  | Perform mounting of electrical components | 40 |
|  | Terminate electrical installation | 10 |
|  | **TOTAL** | **80** |

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

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| * + - * 1. Prepare list of tools, equipment and materials | * 1. Introduction   2. Workshop communication:      1. Oral and Written   3. Values      1. Self-Awareness      2. Stress Management      3. Assertiveness      4. Drug and Substance abuse      5. Time Management   4. Identification of tools and materials e.g.      1. Cutting tools      2. Measuring tools      3. Measuring equipment      4. Cables and conductors      5. Conduits      6. Trunking      7. Consumables   5. Types, application, care, maintenance and storage of:      1. Tools e.g.         1. Cable strippers         2. Pliers         3. Screw drivers         4. Hammers      2. Materials e.g.         1. Cables         2. Fittings         3. Accessories | * Oral questioning * Written tests * Observation * Practical tests |
| * + - * 1. Perform piping and laying of cables | * 1. Safety procedures   2. Procedures for piping   3. Cables and cable joints   4. Surface wiring      1. Cables and accessories used in surface wiring      2. Factors to consider during surface wiring         1. Types and applications e.g. Conduits         2. Preparation of wiring systems; Marking out, cutting, bending,   5. Draw –in/Lay of cables routes   6. Cable Identification   7. IEE regulations   8. General Cleanliness   9. Tools and equipment storage | * Written tests * Observation * Oral questioning * Practical test |
| * + - * 1. Perform mounting of electrical components | * 1. Electrical components e.g.      1. Junction boxes      2. Ceiling rose      3. Switches      4. Socket outlets      5. Bulb holders   2. Component Symbols   3. Safety in electrical installation | * Written tests * Oral questioning * Practical tests * Observation |
| * + - * 1. Terminate Electrical Installation | * 1. Importance of termination   2. Cable labelling   3. Tools used in cable termination e.g.      1. Strip Knife   4. IEE regulations   5. Disposal of waste materials   6. Book Keeping   7. Budgeting | * Written tests * Oral questioning * Practical tests * Observation |

**Suggested Methods of Instruction**

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

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning Materials** |  |  |  |
|  | Textbooks | B. Scaddan Electrical installation work  J. Hyde Electrical installation Principles and Practices | 5 pcs | 1:5 |
|  | Installation manuals | IEEE regulation  BS3939  NEMA regulations  OSHA | 5 pcs | 1:5 |
|  | Charts | Single line diagram  Circuit diagrams  Colour codes | 1 pcs for each | 1:25 |
|  | Power point presentations | For trainer’s use | 1 | 1:25 |
| **B** | **Learning Facilities & infrastructure** |  |  |  |
|  | Lecture/theory room | 50m2 | 1 | 1:25 |
|  | Workshop | 150m2 | 1 | 1:25 |
|  | Laboratory | 100m2 | 1 | 1:25 |
|  | Site |  |  |  |
| **C** | **Consumable materials** |  |  |  |
|  | Electrical wires | 1.0mm2(red, black green) | 5 rolls | 1:5 |
| 1.5mm2(red, black green) | 5 rolls | 1:5 |
|  | Insulation tapes |  | 25 pcs | 1:1 |
|  | Accessories | Switches, sockets, Junction boxes, Consumer units, Lamp holders, Patrice boxes, Circuit breakers, relays, transformers | 25 pcs | 1:1 |
|  | Pipes | PVC conduits, Metallic conduits | 25 pcs | 1:1 |
|  | Wood screws |  | 50 pcs | 1:1 |
| **D** | **Tools and Equipment** |  |  |  |
|  | Hacksaws |  | 25 pcs | 1:1 |
|  | Striping knives |  | 25 pcs | 1:1 |
|  | Side cutters |  | 25 pcs | 1:1 |
|  | Pliers |  | 25 pcs | 1:1 |
|  | Tape measure |  | 25 pcs | 1:1 |
|  | Draw wire |  | 25 pcs | 1:1 |
|  | Try Square |  | 25 pcs | 1:1 |
|  | File |  | 5 pcs | 1:5 |
|  | Spirit level |  | 25 pcs | 1:1 |
|  | Assorted Screw driver |  | 25 pcs | 1:1 |
|  | Assorted hammers |  | 25 pcs | 1:1 |
|  | Crimping tools |  | 5 pcs | 1:5 |
|  | PPEs |  | 25 pcs | 1:1 |
|  | Multi-meters |  | 5 pcs | 1:5 |
|  | Clamp meters |  | 5 pcs | 1:5 |
|  | Earth resistance meter |  | 5 pcs | 1:5 |
|  | Bending spring |  | 5 pcs | 1:5 |
|  | Drilling machines |  | 5 pcs | 1:5 |
|  | Work stations |  | 25 | 1:1 |
|  | Installation boards |  | 13 pcs | 1:2 |

## ELECTRICAL AND ELECTRONIC EQUIPMENT AND APPLIANCE REPAIRS

**UNIT CODE:** 0713 251 17A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Perform electrical and electronic equipment and appliance repairs

**Duration of Unit:** 80 hours

**Unit Description**

This unit covers competencies required to perform electrical and electronic equipment and appliances repair. Competencies include: preparing a list of maintenance tools, equipment and materials, inspecting and testing faulty components, performing maintenance activities and conducting tests on repaired equipment and assemble repaired equipment and appliance

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/NO** | **Learning Outcome** | **Duration (Hours)** |
|  | Prepare a list of maintenance tools, equipment and materials | 10 |
|  | Inspect and test electrical and electronic equipment and appliances | 10 |
|  | Perform maintenance activities | 40 |
|  | Perform tests on repaired equipment and appliances | 10 |
|  | Assemble repaired equipment and appliance | 10 |
|  | **TOTAL** | **80** |

**Learning Outcomes, Content and Suggested Assessment Method**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Prepare a list of maintenance tools, equipment and materials | * 1. Classification of Materials   2. Semi-Conductor Theory   3. Semi-Conductor Diode   4. Classification of tools and instruments e.g.      + 1. Analogue and digital instruments        2. Indicating tools and equipment        3. Measurement tools and equipment        4. Cutting tools and equipment        5. Tightening tools   5. Various specification range in electrical tools and instruments   6. Calibration of instruments   7. Care and Maintenance of tools and equipment’s   8. Draw Electrical and Electronics Symbols   9. Materials in maintenance activities e.g.      1. Cables      2. PCBs | * Written tests * Oral questioning * Practical tests * Observation |
| * 1. Inspect and test faulty components | * 1. Disassembling of various equipment and appliances eg      1. Radio      2. Television      3. Refrigerators      4. Electric kettles      5. Instant showers      6. Air conditioning systems      7. Washing machines      8. Mobile phones      9. Iron boxes      10. Set top boxes   2. Sorting of screws during disassembling   3. Inspecting and testing faulty equipment and appliances   4. Types of tests on power supply system e.g.      1. Test for voltage input      2. Short circuit tests      3. Open circuit tests   5. Troubleshooting methods on various equipment and appliances   6. Safety during testing of power supply system   7. IEE regulation | * Observation * Oral questioning * Written tests |
| * 1. Perform maintenance activities | * 1. Repair/Replacement of faulty components      1. Maintenance activities e.g.         1. Cleaning         2. Tightening         3. Soldering         4. Assembling      2. Disposal of waste materials e.g.         1. Old batteries         2. Lugs and screws         3. Tapes         4. Cable sheaths         5. PCBs         6. Off cuts   2. EHS regulations   3. OSHA regulations | * Observation * Oral questioning * Practical tests * Written tests |
| * 1. Perform tests on repaired equipment and appliances | * 1. Visual inspection   2. Identification of test points   3. Types of tests      1. Continuity tests      2. Short circuit test      3. Operation tests      4. Open circuit test   4. Safe test procedures   5. IEE regulations   6. Source of information      1. Employee      2. Customer Feedback      3. Organization Documents | * Observation * Oral questioning * Practical tests * Written tests |

**Suggested Methods of Instruction**

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

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning Materials** |  |  |  |
|  | Reference books | Mehta, V. K., & Mehta, R. (2020). Principles of electronics (12 edition). S. Chand and Company Limited, Theraja, B. L., & Theraja, A. K. (2005).  A textbook of electrical technology (1st multicolour ed., Multicolour illustrative ed., 23rd rev. multicoloured ed). S. Chand & Co.  Bird, J. O. (2022). Bird’s electrical and electronic principles and technology (Seventh edition). Routledge, Taylor & Francis Group. | 10 pcs for each book | 1:2.5 |
|  | Software | Assorted simulation software  e.g., Circuit wizard. | 25 | 1:1 |
|  | Audio visual presentations | Projector | 1 | 1:25 |
| **B** | **Learning Facilities & infrastructure** |  |  |  |
|  | Lecture/theory room | 60m2 | 1 | 1:25 |
|  | Workshop | 150m2 | 1 | 1:25 |
|  | Computer laboratory | 100m2 | 1 | 1:25 |
| **C** | **Consumable materials** |  |  |  |
| 1. | Electronic components | Breadboards, Stripboards, Jumper wires, Assorted resistors, Assorted capacitors, Assorted MOSFETs, Assorted JFETs, 555 timers, Solder wire, LEDs, Assorted BJT transistors, LDRs, OPAMPs, thermistors, 12V DC motors | 25 pcs | 1:1 |
| **D** | **Tools and Equipment** |  |  |  |
|  | Assorted tools and equipment | Side cutters, Side cutters, Pliers, Screw driver, Crimping tools, Mult-meter, Solder guns | 25 pcs | 1:1 |
|  | Assorted electrical gadgets | Solder gun, Heat sink, Hot air guns, function generator | 25 pcs | 1:1 |
|  | Assorted measuring instruments | Digital Oscilloscope, | 5 for each category | 1:5 |
|  | Digital Multimeter, |  |  |  |
|  | Digital functional generator |  | 3 pcs | 1:8 |
|  | Laser jet printer |  | 2 pcs | 1:13 |
|  | Power supply | Variable power supply, 5V Power adapters, 9V Power adapters, 12V Power adapters. | 10 pcs | 1:3 |
|  | Trainers kit | Analogue training kits, PWM kit | 5 pcs | 1:5 |
|  | PCB prototyping material | Copper board, ferrite chloride solution, see-through printing paper, HASL finishing PCB | 25 for each category | 1:1 |
|  | Drilling gun |  | 3 pcs | 1:8 |
|  | Work stations |  | 25 | 1:1 |

## ELECTRICAL INSTRUMENTATION

**UNIT CODE:** 0713 251 18A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply Electrical Instrumentation

**Duration of Unit: 8**0 hours

**Unit Description**

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

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/NO** | **Learning Outcome** | **Duration (Hours)** |
|  | Demonstrate understanding of measurements | **10** |
|  | Apply electrical instruments | **20** |
|  | Measure of electrical quantities | **20** |
|  | Perform maintenance of electrical instruments | **30** |
|  | **TOTAL** | **80** |

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

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| * + - 1. Demonstrate understanding of electrical measurements | * 1. Units of electrical measurements and symbols   2. Conversions of Unit of measurements | * Written tests * Oral questioning * Practical tests * Observation |
| * + - 1. Apply electrical instruments | * 1. Addition, subtraction, multiplication and division of positive and negative numbers   2. Classifications of instruments      1. Indicating instruments      2. Measuring instruments   3. Analogue Instruments      1. Voltmeter      2. Ohmmeter      3. Ammeter      4. Clamp ammeter      5. Megohmeter      6. Digital multimeter      7. Multimeter probes | * Observation * Oral questioning * Practical tests * Written tests |
| * + - 1. Measure electrical quantities | * 1. Resistance measurement      1. Methods resistance measurements      2. Resistor color coding   2. High resistance measurements      1. Hand-cranked megohmmeter   3. Voltage measurement   4. Current measurement   5. Insulation resistance measurement   6. OSHA regulations | * Observation * Oral questioning * Practical tests * Written tests |
| * + - 1. Perform maintenance of electrical instruments | * 1. Troubleshooting methods on electrical instruments   2. Maintenance activities      1. Repairs/replacing of components      2. Cleaning, soldering, tightening         1. Methods of soldering      3. Instrument configuration and calibration   3. Use of manufacturer’s manuals during maintenance   4. Safety regulations   5. Waste material disposal | * Observation * Oral questioning * Practical tests * Written tests |

**Suggested Methods of Instruction**

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

**Recommended Resources for 25 trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning Materials** |  |  |  |
|  | Reference books | A.K Sawhney  Electrical and Electronic Measurement and Instrumentation.  Arun. K Ghoshi  Introduction to Measurements and Instrumentation 2nd edition  R.K Rajput  Electrical Measurements and Instrumentation 2nd edition | 5 pcs | 1:5 |
|  | Installation manuals | Assorted Systems component Manufacturer’s manuals and data sheets  Instrumentation Handbooks | 5 pcs | 1:5 |
|  | Maintenance manuals | Assorted Systems component Manufacturer’s manuals and data sheets  Maintenance Handbooks | 5 pcs | 1:5 |
|  | Checklists | Assorted Systems checklists | 5 pcs | 1:5 |
|  | Audio visual presentations | Projector | 1 | 1:25 |
| **B** | **Learning Facilities & infrastructure** |  |  |  |
|  | Lecture/theory room | 60m2 | 1 | 1:25 |
|  | Workshop | 150m2 | 1 | 1:25 |
|  | Computer laboratory | 100m2 | 1 | 1:25 |
| **C** | **Consumable materials** |  |  |  |
|  | Installation materials | Indicators, sirens, insulation tape, cables | 25 pcs | 1:1 |
|  | Assorted dies | Moulds, star wheels, guide ways, worm wheels | 5 for each category | 1:5 |
| **D** | **Tools and Equipment** |  |  |  |
|  | Assorted tools and equipment | Side cutters, Side cutters, Pliers, Screw driver, Crimping tools, Mult-meter, torque wrench | 25 pcs | 1:1 |
|  | PPEs | Safety boots, overall | 25 pcs | 1:1 |
|  | Work stations |  | 25 | 1:1 |

**MODULE 2**

## ELECTRICAL INSTALLATION II

**UNIT CODE:** 0713 351 19A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Perform Electrical Installation

**Duration of Unit:** 90 hours

**Unit Description**

This unit specifies the competencies required for performing electrical installation. Competencies required includes, applying EHS standards, preparing working drawings, assembling tools, equipment and materials, performing electrical installation, terminating installation**,** inspecting and testing installation

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/NO** | **Learning Outcome** | **Duration (Hours)** |
|  | Apply EHS Standards | **10** |
|  | Prepare working drawings | **10** |
|  | Assemble tools, equipment & materials | **10** |
|  | Perform electrical installation | **40** |
|  | Terminate installation | **10** |
|  | Inspect and test installation | **10** |
|  | **TOTAL** | **90** |

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

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| * + - * 1. Apply EHS standards | * 1. Meaning of term PPE   2. Purpose of PPE   3. Types of PPE   4. Safe and correct handling, use, maintenance and storage of different types of PPE   5. Classes of fires and fire fighting equipment   6. First aid procedures      1. Rescuing electric shock victim   7. Methods of resuscitation | * Written tests * Oral questioning * Observation |
| * + - * 1. Prepare working drawings | * 1. Meaning of working drawings   2. Types of Working drawings   3. Identification and care of drawing instruments and equipment   4. Identification of drawing paper sizes   5. Drawing various types of lines   6. Drawing title block   7. Drawing standard electrical symbols   8. Conversion of scales | * Observation * Oral questioning * Practical tests * Written tests |
| * + - * 1. Assemble tools, equipment & materials | * 1. Classification of tools e.g.      1. Cutting tools e.g. * Hacksaw * Stripping knife * Side cutter * Pliers   + 1. Measuring tools e.g. * Tape measure * Try square * Steel rule * Spirit level   + 1. Fixing tools e.g. * Hammers * Screw drivers   + 1. Crimping tool     2. Equipment * Multimeter * Stock and die * Vice * Insulation resistance meter * Earth resistance meter * Clamp meter * Pipe bending machine   + 1. Others e.g. * Draw wire * Bending spring * Drill   1. Use, care and maintenance of tools   2. Identification of materials e.g. * Cables * Consumer control unit * Switches, sockets, holders and other accessories * Conduits, trunking etc * Screws   1. Specification of tools, equipment and materials * Tolerance/ range * Make / model * Size * Class   1. Reuse and Disposal of materials   2. Bill of Quantities (BOQ)   3. List and assemble tools, equipment and materials   4. Inventory management * Stock taking * Record keeping | * Observation * Oral questioning * Practical tests * Written tests |
| * + - * 1. Perform electrical installation | * 1. Single phase and three phase installation      1. Domestic Installation   2. Cables and cable joints   3. Wiring systems and accessories      1. Types and applications e.g.         1. Conduits         2. Cable trays         3. Cable ducts      2. Lighting circuits         1. One way, two way, intermediate         2. Looping in methods at ceiling rose, joint boxes, switches   4. Power circuits      1. Radial circuits, ring circuits      2. Water heating circuits      3. Electric cooker circuits      4. Call and alarm circuits      5. Bell circuits      6. Intruder alarm circuits      7. Fire alarm circuits   4.5 Cable labelling  4.6 Disposal of waste materials | * Written tests * Observation * Oral questioning * Practical test |
| * + - * 1. Terminate Electrical Installation | * 1. Importance of termination   2. Cable labelling   3. Cable lugging   4. Tools used in cable termination e.g.      1. Crimping tool      2. Strip Knife   5. IEE regulations   6. Disposal of waste materials | * Written tests * Oral questioning * Practical tests * Observation |
| * + - * 1. Inspect and test electrical Installation | * 1. Types of tests e.g.      1. Earth continuity tests      2. Insulation tests      3. Short circuit tests   2. Earthing points in Electrical installation      1. Methods of earthing      2. Factors to consider in selecting an earthing method      3. Testing an earthing system   3. Testing tools e.g.      1. Multimeters      2. Insulation tester      3. Ohmmeter   4. Importance of testing   5. IEE regulations | * Written tests * Oral questioning * Practical tests * Observation |

**Suggested Methods of Instructions**

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

**List of Recommended Resources for 25 trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning Materials** |  |  |  |
|  | Textbooks | 1. B. Scaddan Electrical installation work 2. J. Hyde Electrical Installation Principles and Practices 3. Electrical Theory for the Electrician**"** by Mike Holt 4. Electrical installation work by Brian Scaddan | 5 pcs | 1:5 |
|  | Installation manuals | IEEE regulation  BS3939  NEMA regulations  OSHA | 5 pcs | 1:5 |
|  | Charts | Single line diagram  Circuit diagrams  Colour codes | 1 pcs for each | 1:25 |
|  | Power point presentations | For trainer’s use | 1 | 1:25 |
| **B** | **Learning Facilities & infrastructure** |  |  |  |
|  | Lecture/theory room | 60m2 | 1 | 1:25 |
|  | Workshop | 150m2 | 1 | 1:25 |
|  | Site |  |  |  |
| **C** | **Consumable materials** |  |  |  |
|  | Electrical wires | 1.5mm2(red, black green) | 5 rolls | 1:5 |
| 2.5mm2(red, black green) | 5 rolls | 1:5 |
| 4.0 mm2(red, black green) | 3 rolls | 1:10 |
| 6.0 mm2(red, black green) | 2 rolls | 1:12 |
| 10 mm2(red, black green) | 2 rolls | 1:12 |
|  | Insulation tapes |  | 25 pcs | 1:1 |
|  | Accessories | Switches, sockets, Junction boxes, Consumer units, Lamp holders, Patrice boxes, Circuit breakers, energy meter, cut out, cooker unit, instant water heater switch, | 25 pcs | 1:1 |
|  | Conduits and trunkings | PVC conduits, Steel conduits, Mini trunking | 25 pcs | 1:1 |
|  | **Tools and Equipment** |  |  |  |
|  | Hacksaws |  | 25 pcs | 1:1 |
|  | Striping knives |  | 25 pcs | 1:1 |
|  | Side cutters |  | 25 pcs | 1:1 |
|  | Pliers |  | 25 pcs | 1:1 |
|  | Tape measure |  | 25 pcs | 1:1 |
|  | Try Square |  | 25 pcs | 1:1 |
|  | Spirit level |  | 25 pcs | 1:1 |
|  | Assorted Screw driver |  | 25 pcs | 1:1 |
|  | Assorted hammers |  | 25 pcs | 1:1 |
|  | PPEs |  | 25 pcs | 1:1 |
|  | Multimeters |  | 5 pcs | 1:5 |
|  | Clamp meters |  | 5 pcs | 1:5 |
|  | Earth resistance meter |  | 5 pcs | 1:5 |
|  | Stocks & Dies |  | 5 pcs | 1:5 |
|  | Vices |  | 5 pcs | 1:5 |
|  | Pipe bending Machine |  | 5 pcs | 1:5 |
|  | Bending spring |  | 5 pcs | 1:5 |
|  | Drilling machines |  | 5 pcs | 1:5 |
|  | Work stations |  | 25 | 1:1 |
|  | Installation boards |  | 13 pcs | 1:2 |

## POWER SUPPLY SYSTEMS

**UNIT CODE:** 0713 351 20A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Install power supply systems

**Duration of Unit:** 70 hours

**Unit Description**

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

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/NO** | **Learning Outcome** | **Duration (Hours)** |
|  | Identify power supply components | **10** |
|  | Assemble tools, equipment and materials | **10** |
|  | Install power supply system | **40** |
|  | Test power supply system | **10** |
|  | **TOTAL** | **70** |

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

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Identify power supply components | * 1. P-N juction   2. Introduction to BJT   3. BJT configuration   4. Meaning of terms   5. Components of power supply e.g.   6. Transformer   7. Single phase rectifiers   8. Filters   9. Voltage regulators   10. Voltage divider   11. DC power converters   12. Protection components of a supply system   13. Fuses   14. Types of fuses   15. Varistor   16. Circuit breakers   17. Types of circuit breakers | * Observation * Oral questioning |
| * + 1. Assemble tools, equipment and materials | 2.1 Classification of tools used in power supply system installation e.g.   * + 1. Analogue and digital instruments     2. Indicating tools and equipment     3. Measurement tools and equipment     4. Cutting tools and equipment     5. Tightening tools   2.2 Printed circuit boards identification | * Written tests * Oral questioning * Practical tests * Observation |
| * + 1. Install power supply system | * 1. Factors to consider in installation of power supply systems   2. Safety during power supply installation   3. Power supply component fixing techniques e.g.      1. Breadboard connections   4. Troubleshooting   5. Common faults in Electrical equipment’s   6. Fault diagnosis procedure   7. Repair/Replace of components in Electrical equipment’s | * Observation * Oral questioning * Practical tests * Written tests |
| * + 1. Test power supply system | * 1. Visual inspection   2. Types of tests e.g.      1. Earth continuity tests      2. Insulation tests      3. Short circuit tests   3. Testing tools e.g.      1. Multimeters      2. Insulation tester      3. Ohmmeter   4. Importance of testing   5. IEE regulations | * Observation * Oral questioning * Practical tests * Written tests |

**Suggested Methods of Instructions**

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

**List of Recommended Resources for 25 trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning Materials** |  |  |  |
|  | Textbooks | 1. B. Scaddan Electrical installation work 2. J. Hyde Electrical Installation Principles and Practices 3. Electrical Theory for the Electrician**"** by Mike Holt 4. Electrical installation work by Brian Scaddan | 5 pcs | 1:5 |
|  | Installation manuals | IEEE regulation  BS3939  NEMA regulations  OSHA | 5 pcs | 1:5 |
|  | Charts | Single line diagram  Circuit diagrams  Colour codes | 1 pcs for each | 1:25 |
|  | Power point presentations | For trainer’s use | 1 | 1:25 |
| **B** | **Learning Facilities & infrastructure** |  |  |  |
|  | Lecture/theory room | 60m2 | 1 | 1:25 |
|  | Workshop | 150m2 | 1 | 1:25 |
|  | Site |  |  |  |
| **C** | **Consumable materials** |  |  |  |
|  | Insulation tapes |  | 25 pcs | 1:1 |
|  | Accessories | Stationery**,** Breadboards**,** Strip Board**,** Assorted Electronic components.**,** UPS**,** Batteries**,** Battery Chargers**,** Assorted Cables**,** Assorted protective devices  , Assorted solar system components | 25 pcs | 1:1 |
|  | Conduits and trunkings | PVC conduits, Mini trunking | 25 pcs | 1:1 |
|  | **Tools and Equipment** |  |  |  |
|  | Hacksaws |  | 25 pcs | 1:1 |
|  | Striping knives |  | 25 pcs | 1:1 |
|  | Side cutters |  | 25 pcs | 1:1 |
|  | Pliers |  | 25 pcs | 1:1 |
|  | Tape measure |  | 25 pcs | 1:1 |
|  | Try Square |  | 25 pcs | 1:1 |
|  | Spirit level |  | 25 pcs | 1:1 |
|  | Assorted Screw driver |  | 25 pcs | 1:1 |
|  | Assorted hammers |  | 25 pcs | 1:1 |
|  | PPEs |  | 25 pcs | 1:1 |
|  | Multimeters |  | 5 pcs | 1:5 |
|  | Clamp meters |  | 5 pcs | 1:5 |
|  | Earth resistance meter |  | 5 pcs | 1:5 |
|  | Soldering Gun |  | 5 pcs | 1:5 |
|  | Solder Suckers |  | 5 pcs | 1:5 |
|  | Assorted spanners and wrenches |  | 5 pcs | 1:5 |
|  | Oscilloscopes |  | 5 pcs | 1:5 |
|  | Bending spring |  | 5 pcs | 1:5 |
|  | Drilling machines |  | 5 pcs | 1:5 |
|  | Work stations |  | 25 | 1:1 |
|  | Draw wire |  | 5 pcs | 1:5 |
|  | Installation boards |  | 13 pcs | 1:2 |

ELECTRICAL AND ELECTRONIC EQUIPMENT AND APPLIANCES MAINTENANCE

**UNIT CODE:** 0713 351 21A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Perform electrical and electronic equipment and appliance maintenance.

**Duration of Unit:** 70 hours

**Unit Description**

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

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/NO** | **Learning Outcome** | **Duration (Hours)** |
|  | Assemble maintenance tools, equipment and materials | **10** |
|  | Inspect and test faulty components | **10** |
|  | Perform maintenance activities | **30** |
|  | Perform tests on repaired equipment and appliances | **10** |
|  | Assemble repaired Equipment and Appliances | **10** |
|  | **TOTAL** | **70** |

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Assemble maintenance tools, equipment and materials | * 1. Classification of tools and instruments e.g.      1. Analogue and digital instruments      2. Indicating tools and equipment      3. Measurement tools and equipment      4. Cutting tools and equipment      5. Tightening tools   2. Various specification range in electrical tools and instruments   3. Calibration of instruments   4. Materials used in power supply installation e.g.      1. Cables      2. PCBs | * Written tests * Oral questioning * Practical tests * Observation |
| 1. Inspect and test faulty components | * 1. Disassembling of various equipment and appliances eg      1. Radio      2. Television      3. Refrigerators      4. Electric kettles      5. Instant showers      6. Printers      7. Photocopiers      8. Microwaves      9. Air conditioning systems      10. Washing machines      11. Mobile phones      12. Iron boxes      13. Set top boxes   2. Sorting of screws during disassembling   3. Inspecting and testing faulty equipment and appliances   4. Types of tests on power supply system e.g.      1. Test for voltage input      2. Short circuit tests      3. Open circuit tests   5. Troubleshooting methods on various equipment and appliances   6. Safety during testing of power supply system   7. IEE regulation | * Observation * Oral questioning * Written tests |
| 1. Perform maintenance activities | * 1. Repair/Replacement of faulty components      1. Maintenance activities e.g.         1. Cleaning         2. Tightening         3. Soldering         4. Assembling   2. Disposal of waste materials e.g.      1. Old batteries      2. Lugs and screws      3. Tapes      4. Cable sheaths      5. PCBs      6. Off cuts   3. EHS regulations   4. OSHA regulations | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Perform tests on repaired equipment and appliances | * 1. Visual inspection   2. Identification of test points   3. Types of tests      1. Continuity tests      2. Short circuit test      3. Open circuit test   4. Safe test procedures   5. IEE regulations | * Observation * Oral questioning * Practical tests * Written tests |
| 1. Assemble repaired equipment and appliance | * 1. Tightening of screws   2. Connectors      1. Types of connectors   3. Use of cable ties, silicon glue, super glue, insulating tapes   4. Mounting of cooling components | * Observation * Oral questioning * Practical tests * Written tests |

**Suggested Methods of Instructions**

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

**List of Recommended Resources for 25 trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning Materials** |  |  |  |
|  | Textbooks | 1. B. Scaddan Electrical installation work 2. J. Hyde Electrical Installation Principles and Practices 3. Electrical Theory for the Electrician**"** by Mike Holt 4. Electrical installation work by Brian Scaddan | 5 pcs | 1:5 |
|  | Installation manuals | IEEE regulation  BS3939  NEMA regulations  OSHA | 5 pcs | 1:5 |
|  | Charts | Single line diagram  Circuit diagrams  Colour codes | 1 pcs for each | 1:25 |
|  | Power point presentations | For trainer’s use | 1 | 1:25 |
| **B** | **Learning Facilities & infrastructure** |  |  |  |
|  | Lecture/theory room | 60m2 | 1 | 1:25 |
|  | Workshop | 150m2 | 1 | 1:25 |
|  | Site |  |  |  |
| **C** | **Consumable materials** |  |  |  |
|  | Insulation tapes |  | 25 pcs | 1:1 |
|  | Accessories | Stationery**,** Breadboards**,** Strip Board**,** Assorted Electronic components.**,** UPS**,** Batteries**,** Battery Chargers**,** Assorted Cables**,** Assorted protective devices  , Assorted solar system components | 25 pcs | 1:1 |
|  | Conduits and trunkings | PVC conduits, Mini trunking | 25 pcs | 1:1 |
|  | **Tools and Equipment** |  |  |  |
|  | Hacksaws |  | 25 pcs | 1:1 |
|  | Striping knives |  | 25 pcs | 1:1 |
|  | Side cutters |  | 25 pcs | 1:1 |
|  | Pliers |  | 25 pcs | 1:1 |
|  | Tape measure |  | 25 pcs | 1:1 |
|  | Try Square |  | 25 pcs | 1:1 |
|  | Spirit level |  | 25 pcs | 1:1 |
|  | Assorted Screw driver |  | 25 pcs | 1:1 |
|  | Assorted hammers |  | 25 pcs | 1:1 |
|  | PPEs |  | 25 pcs | 1:1 |
|  | Multimeters |  | 5 pcs | 1:5 |
|  | Clamp meters |  | 5 pcs | 1:5 |
|  | Earth resistance meter |  | 5 pcs | 1:5 |
|  | Soldering Gun |  | 5 pcs | 1:5 |
|  | Solder Suckers |  | 5 pcs | 1:5 |
|  | Assorted spanners and wrenches |  | 5 pcs | 1:5 |
|  | Oscilloscopes |  | 5 pcs | 1:5 |
|  | Bending spring |  | 5 pcs | 1:5 |
|  | Drilling machines |  | 5 pcs | 1:5 |
|  | Stock and die |  | 5 pcs | 1:5 |
|  | Vice |  | 5 pcs | 1:5 |
|  | Work stations |  | 25 | 1:1 |
|  | Draw wire |  | 5 pcs | 1:5 |
|  | Installation boards |  | 13 pcs | 1:2 |
|  | Bearing pullers |  | 1 pc | 1:25 |