ELECTRICAL-ELECTRONIC ASSEMBLY

CBT Curriculum

National Vocational Certificate Level 2

Version 1 - December 2014

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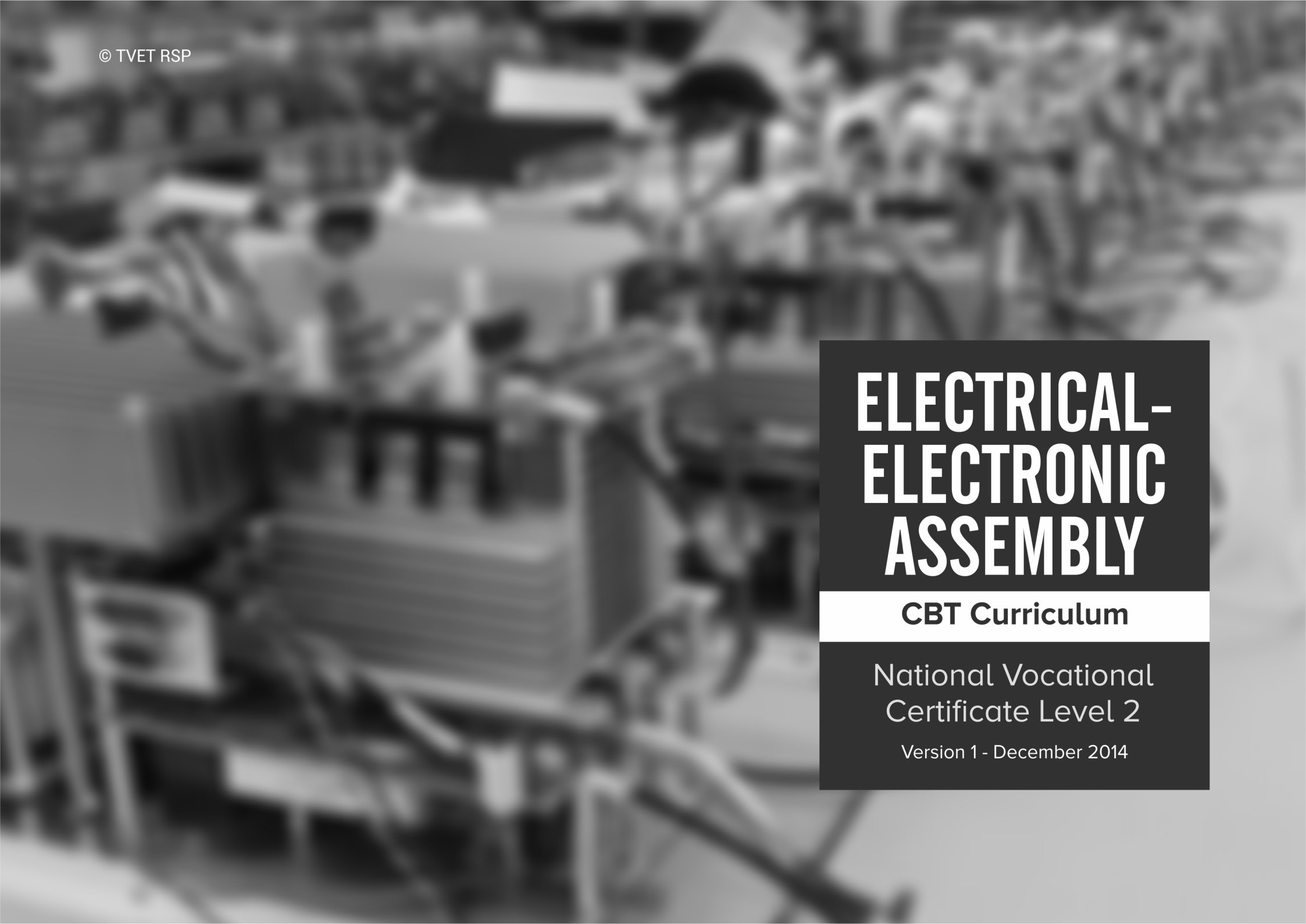

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Contents

1. Introduction

Qualified Electrical & Electronic Assemblers are required for assembly of basic electrical and electronic circuits & machines. They are in high demand and absorbed by a range of industries such as Atomic Energy, Defiance, Fertilizer, Cement, Petro Chemical and Textile Industry. Moreover, Electrical & Electronic Assemblers are also concerned with the assembling, repairing and installation of domestic electrical and electronic appliances such as basic electrical and electronics circuits, DC power supplies, transformers, voltage stabilizers and UPS system.

1.1 Overall course objective

This course will enable the pass outs to work as anElectrical & Electronic Assemblers(Assistant) in Government Organisations such as Army PAF and Navy in engineering core. Moreover they can work in the Atomic energy commission, mobile phone companies, textile, paper and fertilizer factories, petro chemical companies. This training programme also helps the pass out trainees to start their own business like sale and service shops of electronics devices, equipment and spare parts. Trainees can work on these repairing shops and get reasonable earning.

1.2 Course competencies

After completion of training the trainees will be able to:

- Maintain Safety;
- Interpret Drawings;
- Maintain Tools & Equipment;
- Install Wiring;
- Perform Installations and Assembling of Electrical Appliance / items;
- Perform product testing;
- Perform Preventive and Corrective Maintenance;
- Perform Quality Checks; and
- Maintain Documentation.

1.3 Job opportunities

The pass out of this course would be able to:

- Work in Government Organisations like defence, Nuclear and power sector
- Work as electronics technician in an electronics outfit / company / organisation
- Work as electronics technician in cotton, garment, cement, fertilizer, sugar, electrical and electronics industry
- Be self employed by having his own electrical / wiring workshop

1.4 Trainee entry level

Individuals who wish to enter this course of study have to comply against the following criteria:

- Grade 8 (Middle) preferably or equivalent with field experience or level 1 certification in Electrical & Electronic Assembler
- Comfort level of English language and mathematics;
- Satisfactory completion of appropriate admission assessment test.

1.5 Minimum qualification of trainer

Trainers who wish to offer this programme should meet one of the following requirements:

- B.Sc. Engg and 1 year of relevant experience; or
- B-Tech and 2 years of relevant experience; or
- Diploma Associate Engineer (DAE) and 3 years relevant experience; or
- Certificate as Electrical & Electronic Assembler with 5 years relevant experience

Trainers offering this programme must be computer literate and be conversant with the delivery of competency-based education and training (CBET). All legislative requirements applicable to carry out training and assessment, if any, must be complied with.

1.6 Teaching strategies in a competency-based environment

Training in a competency-based environment differs from the traditional method of training delivery. It is based on defined competency standards, which are industry oriented.

The traditional role of a trainer changes and shifts towards the facilitation of training. A facilitator in CBET encourages and assists trainees to learn for themselves. Trainees are likely to work in groups (pairs) and all doing something different. Some are doing practical tasks in the workshop, some writing, some not even in the classroom or workshop but in another part of the building using specialist equipment, working on computers doing research on the Internet or the library. As trainees learn at different pace they might well be at different stages in their learning, thus learning must be tailored to suit individual needs.

The following facilitation methods (teaching strategies) are generally employed in CBET programmes:

- **Direct Instruction Method:** This might beeffective when introducing a new topic to a larger group of trainees in a relative short amount of time. In most cases this method relies on one-way communication, hence there are limited opportunities to get feedback on the trainee's understanding.

- **Discussion Method:** This allows trainees to actively participate in sharing knowledge and ideas. It will help the trainer to determine whether trainees understand the content of the topic. On the other hand, there is a possibility of straying off topic under discussion and some trainees dominating others on their views.

- **Small Group Method:** Pairing trainees to help and learn from each other often results in faster knowledge/skill transfer than with the whole class. The physical arrangement of the classroom/workshop and individual assessment may be challenging.

- **Problem Solving Method:** This is avery popular teaching strategy for CBET. Trainees are challenged and are usually highly motivated when they gain new knowledge and skills by solving problems (Contingency skills). Trainees develop critical thinking skills and the ability to adapt to new learning situations (Transfer skills). It might be time consuming and because trainees sometimes work individually, they may not learn all the things that they are expected to learn.

- **Research Method:** This is used for workshops and laboratory tasks, field experiments, and case studies. It encourages trainees to investigate and find answers for themselves and to critically evaluate information. It however requires a lot of time and careful planning of research projects for the trainee.

1.7 Medium of instructions

- Urdu, local languages and/or English

1.8 Sequence and delivery of the modules

The curriculum for Electrical & Electronic Assembler (Assistant) – NVQF level 2, consists of five (5) modules. The delivery of the modules (sequence) is suggested as follows:

Module 1: Electrical Theory
Module 2: Maintenance
Module 3: Installation and Assembling
Module 4: Testing and troubleshooting
Module 5: Continuing Professional Development

Learning units within these modules can be delivered interchangeably as stand-alone modules or in an integrated approach.

1.9 Duration of the course

The proposed curriculum is composed of 5 modules, which will be delivered over 1600 hours i.e. one (1) year.
The distribution of training hours is as follows:

a) Total Training hours = 1600 Hours
b) Theory = 320 Hours (20%)
c) Practical = 1280 Hours (80%)

2. Overview about the programme – Curriculum for Electrical & Electronic Assembler (Assistant) – NVQF Level 2:

Module Title	Learning Units	Theory[1] Days/hours	Workplace[2] Days/hours	Timeframe of modules
Module 1: Electrical Theory	**LU-1:** Describe basic electrical concepts **LU-2:** Identify hazards associated with electricity **LU-3:** Describe sources of electricity generation **LU-4:** Calculate electrical variables **LU-5:** Perform measurements in electrical circuits **LU-6:** Demonstrate knowledge of electric power **LU-7:** Describe resistive, inductive and capacitive loads **LU-8:** Describe basic magnetic principles	**82**	**46**	**128**
Module 2: Maintenance	**LU-1:** Plan and prepare for work **LU-2:** Use tools and equipment **LU-3:** Inspect and troubleshoot system **LU-4:** Conduct preventive and corrective maintenance	**53**	**444**	**497**

[1]Learning hours in training provider premises
[2]Training workshop, laboratory and on-the-job workplace

Module 3: Installation and Assembling	**LU-1:**Plan and prepare for work **LU-2:**Assemble electrical circuits **LU-3:**Assemble electronic circuits	**89**	**470**	**559**
Module 4: Testing and troubleshooting	**LU-1:** Demonstrate diagnostic procedure **LU-2:** Remove Fault	**75**	**320**	**395**
Module 5: Continuing Professional Development	**LU-1:** Identify professional development needs **LU-2:** Develop professional knowledge, skills and attitudes **LU-3:** Maintain professional proficiency	**21**	**0**	**21**

3. Electrical & Electronic Assembler(Assistant) – Curriculum Contents

Module 1:	**Electrical Theory**				
Objective of the Module:	On completion of this module the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements: • Describe basic electrical concepts • Identify hazards associated with electricity • Describe sources of electricity generation • Calculate electrical variables • Perform measurements in electrical circuits • Demonstrate knowledge of electric power • Describe resistive, inductive and capacitive loads • Describe basic magnetic principles				
Duration:	**Total: 128 hours**	**Theory: 82 hours**		**Practice: 46 hours**	
Learning Unit	**Learning Outcomes**	**Learning Elements**	**Duration (Hours)**	**Materials Required**	**Learning Place**
LU-1: **Describe basic electrical concepts**	1.1 Demonstrate knowledge of electron theory	• Definition of matter • Different states of matter with examples • Definition of atom, molecule and element • Atomic structure and shells • Description of proton, electron and neutron • Definition of valence and free electrons • Properties of positive and negative charge	**Total** 35 Hrs **Theory** 25 Hrs **Practical** 10 Hrs	**Non Consumable** • Digital clamp meter • Generator • Oscilloscope • Analogue meter • Analogue voltmeter • Animation of atomic model • Animation of states of matter	**Theory** Classroom **Practical** Lab Workshop

		• Definition of electricity			

	1.2 Describe current flow	• Conventional current and electron flow theory • Static and dynamic charge		• Atomic model • Clamp meter • Digital multi meter • Electric fan • Electric heater • Permanent and temporary magnets **Consumable** • Balloon • Batteries • Conductor	
	1.3 Define conductor, semi-conductor and insulator	• Properties of conductors, insulators and semiconductors • Types of diodes, e.g. - Photodiode - Zener diode - LED			
	1.4 Apply Ohm's law for DC circuits	• Definition • Laws of resistance • Relation between current (I), voltage (V) and resistance (R)			

	1.5 Describe factors affecting resistance of conductors	• Definition of resistivity • Resistivity of materials • Factors affecting resistance of conductors • Calculating resistance of a conductor with regard to cross sectional area, length, resistivity and operating temperature			
LU-2: **Identify hazards associated with electricity**	2.1 Describe electricity hazards	• Common electricity hazards - Insulation breaks of cable - Identification and Guarding of live parts - Grounding - Electric spark due to any reason - Lack of protection equipment uses - Unawareness	**Total** 08 Hrs **Theory** 05 Hrs **Practical** 03 Hrs		**Theory** Classroom **Practical** Lab Workshop
	2.2 Apply the protection procedures for electric shock	• De energizing electric equipment before inspection or repair • Maintaining electric tools • Working near energized lines • Using protective equipment			

	2.3 Identify safety signs and symbols associated with electricity hazards	• Different safety signs and symbols			

LU-3: **Describe sources of electricity generation**	3.1 Identify sources of electricity generation	• Sources of electricity generation - Static electricity - Electromagnetic induction - Electrochemistry - Photovoltaic effect - Thermoelectric effect - Piezoelectric effect - Nuclear transformation	**Total** 15 Hrs **Theory** 10 Hrs **Practical** 05 Hrs		**Theory** Classroom **Practical** Lab Workshop
	3.2 Nature of electricity (AC and DC) produced by different sources	• Definition of AC and DC electricity • Varying/sinusoidal nature of current and voltage in AC • Non-varying/uniform nature of current and voltage in DC • Importance of polarity in DC circuits			

LU-4: **Calculate electrical variables**	4.1 Demonstrate knowledge of series-, parallel-, and series/parallel electrical circuits	• Circuit layout - Series - Parallel - Series/Parallel • Circuit characteristics - Voltage - Current - Resistance • Fault finding procedures	**Total** 15 Hrs **Theory** 10 Hrs **Practical** 05 Hrs		**Theory** Classroom **Practical** Lab Workshop
	4.2 Calculate electrical quantities in DC circuits based on Ohm's Law	• Ohm's law wheel - Calculating voltage - Calculating current - Calculating resistance - Calculating power			

LU-5: **Perform measurements in electrical circuits**	5.1 Identify digital and analogue instruments	• Definition and examples of analogue and digital display instruments	**Total** 20 Hrs **Theory** 08 Hrs **Practical** 12 Hrs		
	5.2 Measure current and voltage in DC circuit	• Measuring current and voltage in DC circuit • Defining electrical parameters, such as V_{OC}, V_{max}, I_{SC}			
	5.3 Measure frequency of ac signal	• Functioning of oscilloscope • Measuring frequency of ac signal using oscilloscope			
	5.4 Measure real and apparent power	• Definition of real, apparent and reactive power • Relationship between real, apparent and reactive power • Units of real/active, apparent and reactive power • Measuring real and apparent power			
	5.5 Measure voltage and frequency of single and three phase ac signal	• Measuring single phase voltage of ac signal • Measuring three phase voltage of ac signal • Measuring frequency of ac signal			

LU-6: **Demonstrate knowledge of electric power**	6.1 Describe the different ratio for real power, apparent power and reactive power	• Power triangle • Pythagoras theorem • Calculation of angle	**Total** 15 Hrs **Theory** 10 Hrs **Practical** 05 Hrs		
	6.2 Define the terms KVA, KVAR and KW	• Definition of KVA, KVAR and KW			
	6.3 Measure power factor electricity	• Calculate value of reactive power • Definition of power factor • Measuring power factor of main AC line			
	6.4 State the advantages and disadvantages of low power factor and high power factor	• KVA rating • Per unit cost • Power loss • High current • Increases expenses			
	6.5 Explain the causes of low power factor and techniques to improve it	• Causes of low power factor • Disadvantages of low power factor • Techniques to improve power factor			

LU-7 **Describe resistive, inductive and**	7.1 Define resistance, capacitance and inductance	• Definition of resistance, capacitance and inductance • Units and symbols	**Total** 08 Hrs		

capacitive loads	7.2 Differentiate between resistive, inductive and capacitive loads	• Explain with • Examples of resistive loads • Examples of inductive loads • Examples of capacitive load	**Theory** 06 Hrs **Practical** 02 Hrs		
	7.3 Explain importance of electrostatic discharge (ESD)	• Definition of ESD • Adverse effects of ESD			
LU-8: **Describe basic magnetic principles**	8.1 Define permanent and temporary magnets	• Definition 'permanent magnets' • Definition 'temporary magnets'	**Total** 12 Hrs **Theory** 08 Hrs **Practical** 04 Hrs		
	8.2 Define the term 'flux'	• Definition 'flux'			
	8.3 Describe magnetic lines of force and list their characteristics	• Magnetic flux • Flux density			
	8.4 Apply the fundamental laws of magnetism	• Fleming's hand rules • Lenz's law			

Module 2:	**Maintenance**				
Objective of the Module:	On completion of this module the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements: • Plan and prepare for work • Use tools and equipment • Inspect and troubleshoot systems • Conduct maintenance				
Duration:	**Total: 338 hours**	**Theory: 48 hours**		**Practice: 290 hours**	
Learning Unit	**Learning Outcomes**	**Learning Elements**	**Duration (Hours)**	**Materials Required**	**Learning Place**
LU-1: **Plan and prepare for work**	1.1 Identify and obtain safety and other regulatory requirements for maintenance	• Safety requirements, specifications, Hazard identification	**Total** 23 Hrs **Theory** 03 Hrs **Practical** 20 Hrs	**Non Consumable** • Personal protective equipment • Tools and equipment **Consumable** • Drawing sheets • Lead Pencil • Clip board	**Theory** Classroom **Practical** Lab Workshop Local industry
	1.2 Interpret circuit diagrams	• Drawings and symbols specifications			
	1.3 List the tools are required for plan and prepare of work	• Tools and equipment and calibration thereof			

LU-2: **Use tools and equipment**	2.1 Identify and select tools, equipment and instruments for maintenance	• Purpose of tools, equipment and instruments	**Total** 45 Hrs **Theory** 05 Hrs **Practical** 40 Hrs	**Non Consumable** • Electrical tools and machine • Oscilloscope • Generator • Volt meter • Ampere meter • Watt meter • Multi meter **Consumable** • Handouts • Safety procedures legislation • Hydro meter • Insulation tape • Battery	**Theory** Classroom **Practical** Lab Workshop Local industry
	2.2 Demonstration safe use of tools and equipment	• Use of electrical tools, equipment &instruments			
	2.3 Describe preventive maintenance procedures	• Preventive maintenance of: - Tools - Equipment - Instruments - Machinery - Facilities			
	2.4 Maintain and / or replace tool insulation	• Types of insulation and reports			
	2.5 Clean and store electrical tool insulation	• Storage requirements of Tools and equipments			
	2.6 Define the following term • Electrolyte • Error • Zero error • Calibration	• Electrolyte • Error • Zero error • Calibration			
	2.7 Explain key hazards associated with use of tools and equipment	• Cut on any part of body • Slipping of tools and equipment • Bleeding • First add			
	2.8 Identify the state of charge and types of batteries	• Static Charge • Dynamic Charge • Positive Charge • Negative charge			

		• Types of batteries			

	2.9 Maintain electrolyte level	• Role of electrolyte			
	2.10 Describe the procedure for charging batteries	• Charging procedures			
	2.11 Apply the procedure for calibrating measuring instruments	• Types and methods of calibration			
	2.12 Document and interpret calibration	• Types of calibration reports			
	2.13 Calibrate measuring instrument	• Types and methods of calibration • International standards			
	2.14 List the problem that may occur when do calibrating	• Adjusting error • Personal error • Technical error • Equipment error • International standards • Calibrating techniques			
LU-3: **Inspect and troubleshoot systems**	3.1 List the key safety hazards associated with troubleshooting	• Inspection requirements • Troubleshooting requirements	**Total** 85 Hrs **Theory** 15 Hrs **Practical** 70 Hrs	**Non Consumable** • Magger • Earth test meter • Synchronize meter • Clamp on meter • Oscilloscope • Pliers	**Theory** Classroom **Practical** Lab Workshop Local industry
	3.2 Describe the procedures for routine check	• Maintenance of electrical instruments and equipment; Types of common faults of wiring; Load balance; Safety precautions			

	3.3 Define the terms	• Troubleshooting • Fault • Loads • Schedule inspection		• Wire cutter • Screw drivers set **Consumable** • Handouts • Safety hazards • Compass • Extension board	
	3.4 State the document results	• Test and preventive reports			
	3.5 States the remedies for un-balance system	• Natural phase fault • Low power factor • Short circuit • Leakage current • Low quality material			
	3.6 Apply the diagnostic procedures for troubleshooting	• Identification of electrical faults by checking shape, size and colour of components and parts; Measurement of electrical parameters; Safety precautions			
	3.7 Identify faulty parts and / or equipment	• Methods of fault identification in electrical/electronic circuit			
	3.8 Analyze system fault	• System operations in an electrical environment			
	3.9 List the tools for required troubleshooting	• Calibration tools • Testing tools • Operational tools • Personal protective equipment			

LU-4: **Conduct maintenance**	4.1 Explain the key hazards associated with maintenance	• Identify and obtain safety, hazards and other regulatory requirements for conduct maintenance	**Total** 95 Hrs **Theory** 15 Hrs **Practical** 80 Hrs	**Non Consumable** • Bench wise • Battery charger • Pipe wrench • Hand drill machine • Goggles • File set • L Key set • Star Key Set • Magger • Earth test meter • Synchronize meter • Clamp on meter • Oscilloscope • Hand tool set • Extension board • Series board • Phase tester • Ampere meter • AVO meter Soldering iron **Consumable** • Handouts • Safety hazards	**Theory** Classroom **Practical** Lab Workshop Local industry
	4.2 Describe basic measurements tests	• Measurement and calculation of electrical parameters			
	4.3 Apply minor adjustments and calibrations	• Adjustment techniques for electrical equipment and components; Calibration methods			
	4.4 Replace worn out or damaged parts	• Identification of worn out or damaged parts			
	4.5 Describe the procedures of dismantle faulty parts or components	• Dismantling procedures			
	4.6 Replace or repair faulty parts or components	• Replacing and repairing procedures			
	4.7 Perform commissioning	• Electrical load management • Commissioning procedures			
	4.8 Describe the procedure of Complete work related documents	• Importance of documentation • Customer care procedures & techniques			

				• Hydrometer • Torch • Wire gauge • Compass	
	4.9 Explain the purpose of final quality inspection	• Importance of quality handing-over to client		• Extension board • Series board • Phase tester • Ampere meter • AVO meter • Soldering iron	
	4.10 Clean up and store tools, equipment and material	• Waste disposal procedures • Care of tools and equipment			
	4.11 Identify the types of maintenance	• Maintenance types			
	4.12 Distinguish between preventive and corrective maintenance	• Maintenance tools • Schedule of maintenances • Replace and damage • Minor and major maintenance			
	4.13 State the reason for short circuit	• Low quality cable • Increases load • Temperature increases • Un-awareness			
	4.14 Demonstrate the use of Magger for a range of tests	• Operational tests • Open circuit, short circuit, continuity test, earth leakage test • Earthing test			

Module 3:	**Installation and Assembling**				
Objective of the Module:	On completion of this module the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements: • Plan and prepare for work • Assemble electrical circuits • Assemble electronic circuits				
Duration:	**Total: 559 hours**	**Theory: 89 hours**		**Practice: 470 hours**	
Learning Unit	**Learning Outcomes**	**Learning Elements**	**Duration (Hours)**	**Materials Required**	**Learning Place**
LU-1: **Plan and prepare for work**	1.1 Identify and interpret safety and other regulatory requirements	• Safety requirements for assembling - Specifications - Hazard identification • Safety requirements for installation - Specifications - Hazard identification	**Total** 95 Hrs **Theory** 15 Hrs **Practical** 80 Hrs	**Non Consumable** • Soldering and desoldering tools • Multi meter **Consumable** • Circuit diagrams	**Theory** Classroom **Practical** Lab Workshop
	1.2 Identify and select the tools and equipment for work	• Types of tools, equipment and material			
	1.3 Interpret circuit diagrams	• Drawings and symbols • Specifications			

LU-2: **Assemble electrical circuits**	2.1 Confirm assembling and installation specifications	• Assembling requirements • Installation requirements	**Total** 165 Hrs **Theory** 25 Hrs **Practical** 140 Hrs	**Non Consumable** • Line tester • Multi meter • Tool Kit • Test lamp • Series test board • Drill Machine • Hacksaw with various blades **Consumable** • Lamp with holder • 2-pin socket • Board • Connecting wires • Switches • Insulation tape • Screws • Nails • Fuse	**Theory** Classroom **Practical** Lab Workshop Local industry
	2.2 Demonstrate procedures for installing components	• Procedures for installing components			
	2.3 Demonstrate procedures for connecting electrical circuits	• Types of joints • Types of wiring • Types of cables			
	2.4Carry out operational testing	• Testing procedures and equipment			
	2.5Demonstrate procedures for final quality inspection	• Importance of quality • Completing documents • Customer care procedures and techniques • Waste disposal procedures • Care of tools and equipment			

LU-3: **Assemble electronic circuits**	3.1 Draw wiring layout	• Interpretation of drawings, symbols, cable number according to load, and colour coding	**Total** 165 Hrs **Theory** 25 Hrs **Practical** 140 Hrs	**Non Consumable** • Soldering and desoldering tools • Multi meter • Drill Machine • Tool Kit **Consumable** • Copper Coated Sheets • HNO_3 • Permanent Marker • Diodes • Resisters • Capacitors • Hock up wire	**Theory** Classroom **Practical** Lab Workshop Local industry
	3.2Demonstrate procedures for preparing a circuit board	• Material requirements • Assembly manual • Circuit diagram • Procedure for preparing circuit board			
	3.3Demonstrate proceduresfor installing components and connecting electronic circuits	• Tools and equipment • Procedures for installing components • Procedures for connecting electronic circuits			
	3.4Demonstrate procedures for operational testing	• Testing procedures and equipment			
	3.5Demonstrate procedures for preparing a printed circuit board (PCB)	• Design layout • Safety precautions related to working with acids • HNO_3acid and chemical reactions • Drilling procedures			
	3.6Demonstrate procedures for connecting electroniccomponents in PCB	• Interpretation of drawings and circuit diagram • Soldering process and equipment Punching of thimbles			
	3.7 Complete work related documents	• Customer care procedure and techniques			

Module 4:	**Testing and Troubleshooting**				
Objective of the Module:	On completion of this module the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements: • Demonstrate diagnostic procedures • Remove faults				
Duration:	**Total: 395 hours**	**Theory: 75 hours**		**Practice: 320 hours**	
Learning Unit	**Learning Outcomes**	**Learning Elements**	**Duration (Hours)**	**Materials Required**	**Learning Place**
LU-1: **Demonstrate diagnostic procedures**	1.1 Explain the purpose of visual inspection	• Damage identification - cracks - disorders(shape &structure) - broken parts	**Total** 163 Hrs **Theory** 28 Hrs **Practical** 135 Hrs	**Non- Consumables** • Magnifying Glass • Multi-meter • Oscilloscope • Tool Kit • Soldering and desoldering Tools • Test Lamp • Line Tester • Test Boards **Consumables** • Soldering Wire • Desoldering Wire • Past	**Theory** Classroom **Practical** Lab Workshop Local industry
	1.2 Demonstrate procedure for implementing testing	• Process of different tests • Electrical parameters			
	1.3Interpret test results	• Interpretation of drawings andcircuit diagrams			
	1.4Implement troubleshooting procedures and identify fault	• Troubleshooting • Electrical and electronic parameters			

LU-2: **Remove faults**	2.1 Identify the repair or replace component/ parts	• Interpretation of drawings and circuit diagrams; product knowledge	**Total** 62 Hrs **Theory** 12 Hrs **Practical** 50 Hrs	**Non- Consumables** • Magnifying Glass • Multi-meter • Oscilloscope • Tool Kit • Soldering and desoldering Tools • Test Lamp • Line Tester • Test Boards **Consumables** • Soldering Wire • Desoldering Wire Past	**Theory** Classroom **Practical** Lab Workshop Local industry
	2.2 Carry out operational testing	• Product knowledge; Testing procedures and equipment			
	2.3 Explain the reason for short circuit and leakage current	• Breakage of neutral and phase • Short circuits between Phase and neutral • Insulation break of cable • Temperature effect • Load increases • Low quality cable, material • Un-awareness			
	2.4 Identify the fault finding techniques	• Visual inspection • Technical inspection			

Module 5:	**Apply continuing professional development**				
Objective of the Module:	On completion of this module the trainee will be able to demonstrate the following competencies according to industry standards and/or requirements: • Identity professional development needs • Develop professional knowledge, skills and attitudes • Maintain professional proficiency				
Duration:	**Total: 15 hours**	**Theory: 15 hours**		**Practice: 0 hours**	
Learning Unit	**Learning Outcomes**	**Learning Elements**	**Duration (Hours)**	**Materials Required**	**Learning Place**
LU-1: **Identity professional development needs**	1.1 Discuss professional development needs	• Reason s for professional development	**Total** 5 Hrs	**Non Consumable** • Multi media • Projector • Dice • Sound system • White Board **Consumable** • Flip Chart • Writing pad • Lead pencil • High lighter • White board marker	**Theory** Classroom
	1.2 Identify professional development programmes	• Access to programmes • Career guidance	**Theory** 5 Hrs		

LU-2: **Develop professional knowledge, skills and attitudes**	2.1 Participate in training programmes	• Outcomes and relevance of training	**Total** 5 Hrs **Theory** 5 Hrs	**Non Consumable** • Multi media • Projector • Dice • Sound system • White Board **Consumable** • Flip Chart • Writing pad • Lead pencil • High lighter • White board marker	**Theory** Classroom
	2.2 Document training outcome	• Report and portfolio writing			
LU-3: **Maintain professional proficiency**	3.1 Identify and use self-study sources	• Research methods • Access to sources	**Total** 5 Hrs **Theory** 5 Hrs	**Non Consumable** • Multi media • Projector • Dice • Sound system • White Board **Consumable** • Flip Chart • Writing pad • Lead pencil • High lighter • White board marker	**Theory** Classroom
	3.2 Implement self-study plan	• Planning your career			

4. Assessment guidance

Competency-based assessment is the process of gathering evidence to confirm the candidate's ability to perform according to specified outcomes articulated in the competency standard(s).

4.1 Types of assessment

a) Sessional assessment

The goal ofsessional assessment is to monitor student progress in order to provide constant feedback. This feedback can be used by the trainers to improve their teaching and by learners to improve their learning.

More specifically, sessional assessments Help learners to identify their strengths and weaknesses and Help trainers to recognise where learners are struggling and address problems immediately

Examples of sessional assessments include:

- Observations
- Presentations
- Activity sheets
- Project work
- Oral questions

b) Summative (final) assessment

The goal of summative (final) assessment is to evaluate learning progress at the end of a training programme by comparing it against, e.g. set of competency standards.

Examples of summative assessments include:

- Direct observation of work activities
- Final project
- Written questions

4.2 Principles of assessment

When conducting assessment or developing assessment tools, trainers/assessors need to ensure that the following principles of assessment are met:

Validity

- Indicates if the assessment outcome is supported by evidence. The assessment outcome is valid if the assessment methods and materials reflect the critical aspects of evidence required by the competency standards (Competency units, performance criteria, knowledge and understanding).

Reliability

- Indicates the level of consistency and accuracy of the assessment outcomes. The assessment is reliable if the assessment outcome will produce the same result for learners with equal competence at different times or places, regardless of the trainer or assessor conducting the assessment.

Flexibility

- Indicates the opportunity for learners to discuss certain aspects of their assessment with their trainer or assessor, such as scheduling the assessment. All learners should be made aware of the purpose of assessment, the assessment criteria, the methods and tools used, and the context and proposed timing of the assessment well in advance. This can be achieved by drawing up a plan for assessment.

Fair assessment

- Fair assessment does not advantage or disadvantage particular learners because of status, race, beliefs, culture and/or gender. This also means that assessment methods may need to be adjusted for learners with disabilities or cultural differences. An assessment should not place unnecessary demands on learners that may prevent them from demonstrating competence.

4.3 Assessment template – Sessional and Summative assessment

Module Title	Learning Units	Recommended form of assessment	
		Sessional	**Summative**
Module 1: Electrical Theory	**LU-1:** Describe basic electrical concepts **LU-2:** Identify hazards associated with electricity **LU-3:** Describe sources of electricity generation **LU-4:** Calculate electrical variables **LU-5:** Perform measurements in electrical circuits **LU-6:** Demonstrate knowledge of electric power **LU-7:** Describe resistive, inductive and capacitive loads **LU-8:** Describe basic magnetic principles	• Activity sheets • Simulation • Oral and written questions	Integrated assessment: • Project • Demonstration • Role play • Oral and written questions
Module 2: Maintenance	**LU-1:** Plan and prepare for work **LU-2:** Use tools and equipment **LU-3:** Inspect and troubleshoot system **LU-4:** Conduct preventive and corrective maintenance	• Observation • Simulation • Oral and written questions • Demonstration	
Module 3: Installation and Assembling	**LU-1:** Plan and prepare for work **LU-2:** Assemble electrical circuits **LU-3:** Assemble electronic circuits	• Observation • Oral and written questions • Demonstration	
Module 4: Testing and troubleshooting	**LU-1:** Demonstrate diagnostic procedure **LU-2:** Remove Fault	• Observation • Simulation • Oral and written questions • Demonstration	
Module 5: Continuing Professional Development	**LU-1:** Identify professional development needs **LU-2**: Develop professional knowledge, skills and attitudes **LU-3**: Maintain professional proficiency	• Activity sheets • Oral and written questions	

5. List of Tools, Machinery & Equipment

Occupational title	Electrical & Electronic Assembler (Assistant) – Level 2	
Duration	12 months	
Sr. No.	**Name of Item/ Equipment / Tools**	**Quantity**
1.	Dust proof lab	01
2.	Counter set	07
3.	Class chairs	35
4.	AC (Humidity free)	01
5.	Oscilloscope	03
6.	Frequency counter	05
7.	AF signal generator	05
8.	DC regulator power supply	07
9.	UPS system	03
10.	Audio power amplifier	07
11.	Earth leakage (Circuit breaker)	07
12.	Dust blower machine	02
13.	Electrical drill machine	02
14.	Digital winding machine	07
15.	Project board	10
16.	Ceiling fan	02
17.	Bracket fan	02

18.	Computer system	01
19.	Pliers	10
20.	Nose pliers	10
21.	Wire stripper	10
22.	Spanner set	02
23.	Files	07
24.	Screw driver (flat	10
25.	Screw driver (Phillips)	10
26.	Hammer	07
27.	Rubber mallet	07
28.	Centre punch	07
29.	Hack saw	07
30.	Soldering gun	07
31.	Heat air gun	07
32.	Glue gun	07
33.	Digital multi meter	10
34.	Digital clamp meter (AC & DC)	10
35.	Digital LCR meter	05
36.	EHT probe meter	05
37.	Degaussing coil	02
38.	IC Inserter & Exeter kit	07

39.	Workshop scissor	10
40.	Workshop knife	10
41.	Magnifier (Glass)	07
42.	Screw driver set	10

6. List of Consumable Supplies

Occupational title	Electrical & Electronic Assembler (Assistant) – Level 2		
Duration	12 months		
Sr. No.	**Name of Item/ Equipment / Tools**	**Range**	**Quantity**
1.	Wire	3/29	200 meter
2.	Hock up wire	6 core	50 meter
3.	Single way switch	10 Ampere	50 piece
4.	Two pin socket	10 Ampere	50 piece
5.	Two way switch	10 Ampere	20 piece
6.	Lamp holder	Piano type	50 piece
7.	Lamp	100 & 200 watt	50 piece
8.	Energy saver	25 watts	10 piece
9.	Two pole mane switch	10 Ampere	10 piece
10.	Duck putty	3*4 inch	01 bundle
11.	Fuse	10 Ampere	10 Piece
12.	Salad Bound	Delphi	20 Piece
13.	Board (Plastic)	4*4 Inch	10 Piece
14.	Board (Plastic)	4*7 Inch	10 Piece
15.	Resistors	Different values	1000 Piece
16.	Variable resistors	Different values	100 Piece
17.	Capacitors	Different values	500 Piece
18.	Transistors	Different values	1000 Piece

19.	ICs	Different values	100 Piece
20.	Diodes	2 & 4 Ampere	500 Piece
21.	Zener diode	Different values	100 Piece
22.	LED, s	Different colours	1000 piece
23.	Ana log Multi meter	MF – China	10 piece
24.	Ana meld wire	Modern	04 Kg
25.	Soldering Iron	60 Watts	10 Piece
26.	Casing (Body) of Stabilizer	Body with assures	05 Piece
27.	Transformer	12+25+25 volts	05 Piece
28.	Dry Batteries	1.5,3,6,12 Volts	30 Piece
29.	Casing of sound system	With assures	05 piece
30.	Casing of UPS	With assures	03 piece
31.	UPS Module	4+4, 6+6, 7+7 (FETs)	03 piece
32.	UPS Transformer	500,750,1000 Watts	03 piece
33.	UPS Circuit	Wriggle card (12 Volt)	03 piece
34.	Hydro meter	Gravity meter	02 piece

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