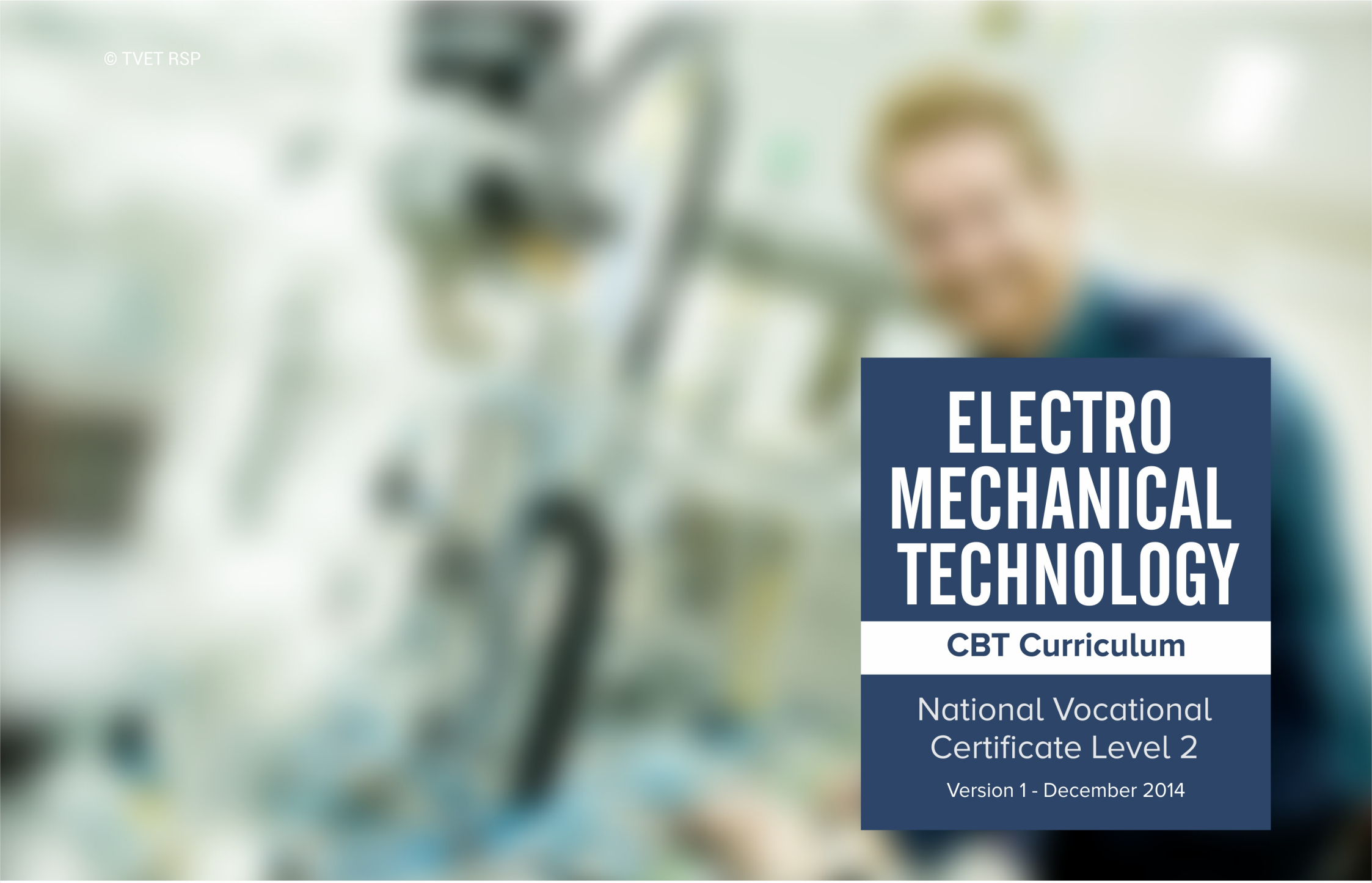

ELECTRO MECHANICAL TECHNOLOGY

CBT Curriculum

National Vocational Certificate Level 2

Version 1 - December 2014

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1. Introduction

The construction industry is one of the leading businesses in Pakistan as well as in Middle East and other parts of the world. The ElectroMachine Technician plays a vital role in installation and maintenance of electrical appliances. The use of electrical machines and appliances has increased manifold over the last few decades. The maintenance of these appliances has created an opportunity for skill training in this field.

1.1 Overall course objective

The aim of this programme is to produce employable Electrical Machine Technician who could provide installation and maintenance services of electrical machines and appliance. In addition, this programme aims to prepare unemployed youth to find employment in the construction industries or to enable them in becoming successful as entrepreneur.

1.2 Course competencies

After completion of training the trainees will be able to:

- Developed professionalism associated with the electrical installer and repairer trade;
- 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 rewinding;
- Perform Quality Checks; and
- Maintain Documentation.

1.3 Job opportunities

The pass out of this course would be able to:

- Work in education department as electrical machine technician
- Work in hospitals as Electrical Machine technician
- Work in small & big construction units as Electrical Machine technician
- Work as Electrical Machine technician in different industries and workshops
- Be self employed by having his own repair 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) or equivalent;
- Comfort level of English language and mathematics;
- Satisfactory completion of appropriate admission assessment test.

1.4.1 Duration 12 Months

1.5 Minimum qualification of trainer

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

- B.Sc. Eng preferably with relevant work experience; or
- B-Tech and 1 years of relevant work experience; or
- Diploma Associate Engineer (DAE) and 2 years relevant work experience; or
- Certificate as Electrical Machine Technician with 5 years relevant work experience

Trainers offering this programme must be computer literate and preferably 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 CBETprogrammes:

- **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 Machine Technician (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: Installation and Assembling
Module 3: Maintenance
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 Machine Technician(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: Installation and Assembling	**LU-1:**Plan and prepare for work **LU-2:**Install machines and appliances **LU-3:**Perform operational testing **LU-4:** Monitor load	**89**	**470**	**559**

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

Module 3: 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**	**474**	**497**
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 Machine Technician(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 • Definition of electricity	**Total** 35 Hrs **Theory** 25 Hrs **Practical** 10 Hrs	**Non Consumable** • Oscilloscope • Digital clamp meter • Generator • Oscilloscope • Analogue meter • Analogue voltmeter • Animation of atomic model • Animation of states of matter • Atomic model • Clamp meter • Digital multi meter • Electric fan	**Theory** Classroom **Practical** Lab Workshop

				• Electric heater	

	1.2 Describe current flow	• Conventional current and electron flow theory • Static and dynamic charge		• Permanent and temporary magnets **Consumable** • Balloon • Batteries • Conductor	
	1.3 Define conductor, semi-conductor and insulator	• Properties of conductors, insulators and semiconductors • Use of semi-conductors in diodes & its basic operation • Types of diodes, e.g. - Photodiode - Light Emitting Diode - Rectifier Diode - Zener Diode			
	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 - Guarding or identification of live parts - Grounding - Electric spark due to increased load - Lack of protection equipment uses - Unawareness of procedures	**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 or 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	**Total** 15 Hrs **Theory** 10 Hrs **Practical**		**Theory** Classroom **Practical**

		- Voltage - Current - Resistance • Fault finding procedures	05 Hrs		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			
	4.3 Calculate electrical quantities in AC circuits based on Ohm's law	• Ohms' Law for AC circuits • Ohms' Law for DC circuits			
LU-5: **Perform measurements in electrical circuits**	5.1 Identify digital and analogue instruments	• Definition and examples of analogue display instruments • Function of digital clamp meter	**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 grid electricity	• Functioning of oscilloscope • Measuring frequency of grid electricity 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 grid electricity	• Measuring single phase voltage of grid electricity • Measuring three phase voltage of grid electricity • Measuring frequency of grid electricity			

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 of grid 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 capacitive loads**	7.1 Define resistance, capacitance and inductance	• Definition of resistance, capacitance and inductance • Units and symbols	**Total** 08 Hrs **Theory** 06 Hrs **Practical** 02 Hrs		
	7.2 Differentiate between resistive, inductive and capacitive loads	• Examples of resistive loads • Examples of inductive loads • Examples of capacitive load			
	7.3 Explain importance of electrostatic discharge (ESD)	• Definition of ESD • Adverse effects of ESD			
LU-8: **Describe basic magnetic**	8.1 Define permanent and temporary magnets	• Definition ‘permanent magnets’ • Definition ‘temporary magnets’	**Total** 12 Hrs		

principles	8.2 Define the term ‘flux’	• Definition ‘flux’	**Theory** 08 Hrs **Practical** 04 Hrs		
	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:	**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 • Install machines and appliances • Perform operational test • Monitor load				
Duration:	**Total: hours**	**Theory: hours**		**Practice: hours**	
Learning Unit	**Learning Outcomes**	**Learning Elements**	**Duration (Hours)**	**Materials Required**	**Learning Place**
LU-1:	1.1 Identify, obtain and	• Safety requirements for	**Total**		**Theory**

Plan and prepare for work	interpret safety and other regulatory requirements	assembling - Specifications - Hazard identification • Safety requirements for installation - Specifications - Hazard identification • Purpose of work permit • Types of work permit • Earthing requirements	170 Hrs **Theory** 25 Hrs **Practical** 145 Hrs		Classroom **Practical** Lab Workshop
	1.2 Identify correct position and location for installation	• Importance of correct position and location • Physical structure • Review layout plan			
	1.3 Identify and select the tools and equipment for work	• Types of tools, equipment and material			
	1.4Interpret circuit diagrams	• Drawings and symbols • Specifications			

LU-2: **Install machines and appliances**	2.1 Confirm assembling and installation specifications	• Assembling requirements • Installation requirements	**Total** 230 Hrs **Theory** 40 Hrs **Practical** 190 Hrs		**Theory** Classroom **Practical** Lab Workshop Local industry
	2.2 Position and configure machine	• Importance of correct position and location • Safety precautions			
	2.3Demonstrate procedures for installing components and connecting electrical circuit with part	• Procedures for installing components • Types of joints • Types of wiring • Types of cables • Joining methods			

		• Concept of neutral, phase and earth • Input / Output voltage • Safety precautions • Confirming assembling			
	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			

LU-3: **Perform operational testing**	3.1 Demonstrate procedures for testing and adjusting components / parts	• Procedures for functional testing and adjustments	**Total** 165 Hrs **Theory** 25 Hrs **Practical** 140 Hrs		**Theory** Classroom **Practical** Lab Workshop Local industry
	3.2Demonstrate procedures for commissioning a machine	• Basic operation of machine • Settings to adjust performance • Permit closing			
	3.3Explain operation of product or appliance to customer	• Product knowledge • Communication skills			
LU-4: **Monitor load**	3.1 Explain the procedures for monitoring load	• Procedures for current & voltage measurements	**Total** 165 Hrs **Theory** 25 Hrs **Practical** 140 Hrs		**Theory** Classroom **Practical** Lab Workshop Local industry
	3.2Describe procedures to monitor power consumption	• Methods of energy measurement in KWH			
	3.3Explain procedures for monitoring voltage drops	• Procedures for voltage measurements (Volt)			
	3.4 Demonstrate log out/tag out procedures	• Procedures for log out/tag out and labeling			

Module 3:	**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 • Earthing requirements	**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 to plan and prepare for work	• Tools and equipment and calibration thereof			
	1.4 Select and isolate electrical cables	• Types and sizes of cables • Tools for cable works			
LU-2:	2.1 Identify and select tools, equipment and instruments	• Purpose of tools, equipment and	**Total**	**Non Consumable**	**Theory**

Use tools and equipment	for maintenance	instruments	45 Hrs **Theory** 05 Hrs **Practical** 40 Hrs	• Electrical tools and machine • Oscilloscope • Generator • Hydro meter • Volt meter • Ampere meter • Watt meter • Multi meter **Consumable** • Handouts • Safety procedures legislation • Insulation tape • Battery	Classroom **Practical** Lab Workshop Local industry
	2.2 Demonstrate safe use of tools and equipment	• Proper use of electrical tools, equipment &instruments			
	2.3 Describe preventive maintenance procedures	• Preventive maintenance - Tools - Equipment - Instruments - Machinery - Facilities			
	2.4 Maintain / replace tool insulation	• Types of insulation and report prepration			
	2.5 Clean and store electrical tool insulation	• Storage requirements			
	2.6 Define the following terms	• Electrolyte • Error • Zero error • Calibration			
	2.7 Explain key hazards associated with use of tools and equipment	• Electrical insulation faliure • Slipping of tools and equipment • Injuries & Shock • First aid			
	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	• Composition of electrolyte • Role of electrolyte			
	2.10 Describe the procedure for charging batteries	• Charging procedures • Charging precautions			
	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 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 meter • 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	• Normal working • Indication of problem • Types of common faults of wiring; Load balance; Safety precautions			
	3.3 Define the terms	• Troubleshooting • Fault		• Wire cutter	

		• Loads • Schedule inspection		• Screw drivers • Compass • Extension board **Consumable** • Handouts • Safety hazards chart	
	3.4 State the result documents	• Test and preventive reports			
	3.5 States the remedies for un-balanced 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 components			
	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 tools			

LU-4: **Conduct maintenance**	4.1 Explain the key hazards associated with maintenance	• Identify and obtain safety, hazards and other regulatory requirements to conduct maintenance	**Total** 95 Hrs **Theory** 15 Hrs **Practical** 80 Hrs	**Non Consumable** • Bench vice • Battery charger • Pipe wrench • Hand drill machine • Goggles • File set • L Key set • Magger meter • Earth test meter • Synchronize meter • Clamp on meter • Oscilloscope • Hand tool set • Hydrometer • Torch • Wire gauge Compass **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 to dismantle faulty parts or components	• Dismantling procedures			
	4.6 Replace or repair faulty parts or components	• Replacing and repairing procedures			
	4.7 Perform commissioning	• Commissioning procedures			
	4.8 Describe the procedure of Complete work related documents	• Importance of documentation • Customer care procedures & techniques			
	4.9 Explain the purpose of final quality inspection	• Importance of final quality inspection and handing-		• Extension board	

		over to client		• 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	• Preventive • Corrective			
	4.12 Distinguish between preventive and corrective maintenance	• Maintenance tools • Schedule of maintenances • Replace damaged parts • Minor and major maintenance			
	4.13 State the reason for short circuit	• Low quality cable • Increased load • Temperature increase • Un-awareness of procedures			
	4.14 Demonstrate the use of Magger meter for a range of tests	• Operational tests • Open circuit, short circuit, continuity test, earth leakage test • Earthing test			

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: hours**	**Theory: hours**		**Practice: 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 - shape andstructure - broken parts - leakages	**Total** 270 Hrs **Theory** 50 Hrs **Practical** 220 Hrs	**Non Consumable** • Oscilloscope • Multimeter • Earthing meter • Magger meter • Pliers • Screw drivers • Spanners • Wire cutter • Wire stripers • Invertors • Hydrometer • Compass **Consumable** • Safety Hazards Chart • Series Board • AC / DC wires	**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 • Possible faults - Winding insulation - Bearing problem - Coupling fault			

		- Rotor/stator fault		• Batteries • Nuts and bolts	

LU-2: **Remove faults**	2.1 Identify the repair or replace component parts	• Interpretation of drawings and circuit diagrams • Product knowledge	**Total** 125 Hrs **Theory** 25 Hrs **Practical** 100 Hrs		**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 natural and phase • Short circuits between Phase & neutral • Insulation break of cable • Temperature effect • Load increase • Low quality cable, material • Un-awareness of procedures			
	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 **Practical** Lab Workshop Local industry
	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 **Practical** Lab Workshop Local industry
	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 **Practical** Lab
	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
- Written assignments

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

- Oral 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: Installation and Assembling	**LU-1:** Plan and prepare for work **LU-2:**Install machines and appliances **LU-3:** Perform operational testing **LU-4:** Monitor load	• Observation • Oral and written questions • Demonstration	
Module 3: 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 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 For 25 trainees

Occupational title	Electrical Machine Technician (Assistant) – Level 2	
Duration	12 months	
Sr. No.	**Name of Item/ Equipment / Tools**	**Quantity**
1.	Adjustable power supply	5
2.	Barrication kit	5
3.	Battery tester	5
4.	Bench vice	5
5.	Chisel bradawl	5
6.	Clamp on meter	5
7.	Crimping tool	5
8.	Drill machine	5
9.	Earthing / discharging set	5
10.	Electrician tool kit	5
11.	File set	5
12.	Fire-fighting equipment	5
13.	First Aid kit	5
14.	Grinder	5
15.	Hacksaw	5
16.	Hammer set	5
17.	Hipot tester	5

18.	Hole saw	5
19.	Hydraulic cable cutter	5
20.	Hydro meter	5
21.	Insolation tester	5
22.	IR temperature gun	5
23.	Level	5
24.	L-scale	5
25.	Lugs punch hydraulic	5
26.	Magnifier glass	25
27.	Magnifier lamp	5
28.	Maggermeter	5
29.	Miliohmmeter	5
30.	Mirco meter	5
31.	Motor test bench	5
32.	Motor winding machine	5
33.	Multi meter	25
34.	Personal protective equipment (PPE)	25
35.	Phase sequence tester	5
36.	Pipe wrench	5
37.	Power factor meter	5
38.	Screw wrench	5

39.	Solder sucker	25
40.	Soldering gun	25
41.	Sound scope	5
42.	Tacho meter	5
43.	Thimble press plier	5
44.	Vernier caliper	25
45.	Vibro meter	5
46.	Weighing machine	5
47.	Winding die set	5
48.	Wire gauge	5

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