National Vocational Certificate Level 2 in Industrial Electrician

CBT Curriculum

NATIONAL VOCATIONAL & TECHNICAL TRAINING COMMISSION

NAVTTC نیوٹک

National Vocational & Technical Training Commission
5th Floor, Evacuee Trust Complex
Sector F-5/1, Islamabad
Tel: +92 51 904404
Fax: +92 51 904404
Email: info@navttc.org

Author:

Engr. Ghazanfar Abbas (Senior Manager Curriculum – PVTC), Mr. Jamil Akhtar (Instructor - VTI Bhalwal)

Reviewed by:

Mr. Muhammad Mahmood Javaid (Technical & Vocational Educationist VTI Mamukanjan) , Mr. Muhammad Aslam (Assistant Manager Saigol group of companies) , Mr. Muhammad Waqas (Electrical Engineer Shahaen Solar Company Lahore) , Mr. Muhammad Aamir (Assistant Manager Electrical Punjab Industrial Estates Lahore)

Layout and Design by:

Ms. Maria Arif (Freelance Consultant)

Date of approval by NCRC:

29th -30th October 2014

Date of Notification:

10th December 2014, vide notification no F.2-1/2013-DD(VT)

This curriculum has been produced by the National Vocational & Technical Training Commission (NAVTCC) with the technical assistance of TVET Reform Support Programme, which is funded by the European Union, the Embassay of the Kingdom of the Netherland, Federal Republic of Germany and the Royal Norwegian Embassy. The Programme has been commissioned by the German Federal Ministry for Economic Cooperation and Development and is being implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.

Contents

1. Introduction

The industrial growth has created a demand for skilled manpower in Pakistan and abroad. Nowadays, many industries are heavily dependent on electrical power and subsequently on skilled Industrial Electricians. This has created an opportunity for skill training in the field of industrial electrician to meet the ever-growing demand of industry. As a consequence, this course has been designed and developed to achieve the objectives of providing appropriate skills.

1.1 Overall course objective

The aim of this programme is to produce employable Industrial Electricians who could provide the services of installation of appliances. 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 Appliances installer and Electrification;
- Maintain Safety;
- Interpret Drawings;
- Maintain Tools & Equipment;
- Install Wiring;
- Perform Installations and Electrification 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 education department as electrical Assistant Electrician.
- Work in hospitals as Assistant Electrician
- Work in small & big construction units as Assistant Electrician
- Work as Assistant Electrician in different industries and workshops
- Be self employed by having his own Electrician 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;
- Basic literacy ,numeracy and life skills;
- 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:

- Diploma Associate Engineer (DAE) and 5 years relevant work experience; or
- Certificate as Industrial Electrician with 8 years relevant work 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 be effective 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 a very 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,/ English(Functional)

1.8 Sequence and delivery of the modules

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

Module 1: Relevant Electrical Theory
Module 2: Maintenance
Module 3: Installation and Electrification
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 Industrial Electrician (Assistant) – NVQF Level 2:

Module Title	Learning Units	Theory[1] Days/hours	Workplace[2] Days/hours	Timeframe of modules
Module 1: Relevant 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**	**474**	**527**

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

Module 3: Installation and Electrification	**LU-1:** Plan and prepare for work **LU-2:** Install machines and appliances **LU-3:** Demonstrate routine electrical measurement procedures **LU-4:** Monitor load	**89**	**440**	**529**
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. Industrial Electrician (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 • Analogue Amp meter • Analogue voltmeter • Digital multi meter • Electric fan • Electric heater • Permanent and temporary magnets • Wattmeter • Frequency meter • Resistive ,Inductive and Capacitive load	**Theory** Classroom **Practical** Lab Workshop

				circuits **Consumable** • Animation of atomic model • Animation of states of matter	
	1.2 Describe current flow	• Conventional current and electron flow theory • Static and dynamic charge		• Atomic model • Balloon • Batteries • Clamp meter • Conductor	
	1.3 Define conductor, semi-conductor and insulator	• Properties of conductors, insulators and semiconductors • Types of diodes, e.g. - Photodiode - Reversing diode - Blocking 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 - Lightening Arrestor - 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 • Techniques of 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 - 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			
	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**	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	• 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: hours**	**Theory: hours**		**Practice: 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** 72 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 checking reports thereof			
LU-2: **Use tools and**	2.1 Identify and select tools, equipment and instruments for maintenance	• Purpose of tools, equipment and instruments	**Total** 45 Hrs	**Non Consumable** • Electrical tools and machine	**Theory** Classroom

equipment	2.2 Demonstration safe use of tools and equipment	• Use of electrical tools, equipment & instruments	**Theory** 05 Hrs **Practical** 40 Hrs	• Oscilloscope • Generator • Volt meter • Ampere meter • Watt meter • Multi meter **Consumable** • Handouts • Safety procedures legislation • Hydro meter • Insulation tape • Battery	**Practical** Lab Workshop Local industry
	2.3 Describe preventive maintenance procedures	• Preventive maintenance - Tools - Equipment - Instruments - Facilities			
	2.4 Maintain and / or replace tool insulation	• Types of insulation and reports			
	2.5 Clean and store electrical tool insulation	• Storage requirements			
	2.6 Define the following term	• 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 • Dynamic • 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 Document and interpret calibration	• Types of calibration reports			
	2.12 Apply the procedure for the adjustment of Basic /Common errors	• Adjusting zero error • Personal error			
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** • Insulation tester • Earth test meter • Phase sequence 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 **Consumable** • Handouts • Safety hazards • Compass • Extension board • Insulation Tape • Assorted Cables • Assorted Switches	
	3.4 State the document of results	• Test and preventive reports			
	3.5 States the remedies for un-balance system	• Earth fault • Low power factor • Short circuit • Leakage current • Low quality material			
	3.6 Apply the diagnostic procedures for	• Identification of electrical faults by checking shape,			

	troubleshooting	size and colour of components and parts; Measurement of electrical parameters; Safety precautions		/Sockets • Contact Cleaner • Rust Cleaner	
	3.7 Identify faulty parts and / or equipment	• Methods of fault identification in electrical components			
	3.8 List the tools for required troubleshooting	• 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 for 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 • Insulation tester • Earth test meter • Phase sequence meter	**Theory** Classroom **Practical** Lab Workshop Local industry
	4.2 Describe basic measurements tests	• Measurement and calculation of electrical parameters			
	4.3 Apply minor adjustments	• Adjustment techniques for electrical equipment and components;			
	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	• Dismantling procedures			

	components			• Clamp on meter • Oscilloscope • Hand tool set **Consumable** • Handouts • Safety hazards • Charge controller • Hydrometer • Torch • Wire gauge • Compass	
	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			

	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 requirements			
	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 Insulation tester for a range of tests	• Operational tests • Open circuit, short circuit, continuity test, earth leakage test • Earthing test			

Module 3:	**Installation and Electrification**				
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 wiring • Demonstrate routine electrical measurement procedures • Monitor load				
Duration:	**Total: hours**	**Theory: hours**		**Practice: hours**	
Learning Unit	**Learning Outcomes**	**Learning Elements**	**Duration (Hours)**	**Materials Required**	**Learning Place**
LU-1: **Plan and prepare for**	1.1 Identify, obtain and interpret safety and other regulatory requirements	• Safety requirements for installation - Specifications - Hazard identification	**Total** 170 Hrs		**Theory** Classroom

work		- Specifications - Hazard identification • Purpose of work permit • Earthing requirements	**Theory** 25 Hrs **Practical** 145 Hrs		**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			
	1.4 Interpret circuit diagrams	• Drawings and symbols • Specifications			

LU-2: **Install wiring**	2.1 Confirm wiring specifications	• Wiring requirements	**Total** 230 Hrs **Theory** 40 Hrs **Practical** 190 Hrs	**Non Consumable** • Pliers • Side cutter • Wire striper • Screw drivers • Hacksaw • Bench wise • Earth meter • Earthing rod • Magnetic compass • Clamp meter • Metal frame	**Theory** Classroom **Practical** Lab Workshop Local industry
	2.2 Prepare installation of cables	• Chiselling • Ducting			
	2.3 Demonstrate procedures for installing conduits and/or ducts	• Properties of material - PVC pipes - GI pipes			
	2.4 Demonstrate procedures for connecting fixture	• Application of cables and tools • Types of joints • Types and purpose of fixtures			
	2.5 Perform final testing	• Procedures for final testing • Tools and equipment			

	2.6 Demonstrate procedures for final quality inspection	• Importance of quality • Completing documents • Customer care procedures and techniques • Waste disposal procedures • Care of tools and equipment		• Drill machine **Consumable** • Handouts	

LU-3: **Demonstrate routine electrical measurement procedures**	3.1 Demonstrate procedures for inspecting wiring and distribution board	• Procedures for inspecting • Importance of continuity and factors of loose fittings	**Total** 165 Hrs **Theory** 25 Hrs **Practical** 140 Hrs		**Theory** Classroom **Practical** Lab Workshop Local industry
	3.2 Conduct operational and functional tests	• Procedures for operational and functional testing			
	3.3 Demonstrate log out/tag out procedures	• Procedures for log out/tag out • Labeling			
LU-4: **Monitor load**	4.1 Explain the procedures for monitoring load	• Procedures for current measurements (Amperes)	**Total** 165 Hrs **Theory** 25 Hrs **Practical** 140 Hrs		**Theory** Classroom **Practical** Lab Workshop Local industry
	4.2 Describe procedures to monitor power consumption	• Methods of energy measurement in KWH			
	4.3 Explain procedures for monitoring voltage drops	• Procedures for voltage measurements (Volt)			
	4.4 Demonstrate log out/tag out procedures	• Procedures for log out/tag out and labeling			

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 and structure - broken parts	**Total** 270 Hrs **Theory** 50 Hrs **Practical** 220 Hrs	**Non Consumable** • Oscilloscope • Multi meter • Earthing meter • Insulation tester **Consumable** • Safety Hazards Charts • Pliers • Screw drivers • Spanners • Wire cutter • Wire stripers • AC / DC wires • Batteries • Invertors • Hydrometer • Compass • Nuts and bolts	**Theory** Classroom **Practical** Lab Workshop Local industry
	1.2 Demonstrate procedure for implementing testing	• Process of different tests • Electrical parameters			
	1.3 Interpret test results	• Interpretation of drawings and circuit diagrams			
	1.4 Implement troubleshooting procedures and identify fault	• Troubleshooting • Electrical and electronic parameters • Possible faults - Winding insulation - Bearing problem - Coupling fault - Rotor/stator fault			

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 Neutral and phase • Short circuits between Phase 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 **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
	1.2 Identify professional development programmes	• Access to programmes • Career guidance			

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 of sessional 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: Relevant 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 Electrification	**LU-1:** Plan and prepare for work **LU-2:** Install machines and appliances **LU-3:** Demonstrate routine electrical measurement procedures **LU-4:** Monitor load	• 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	Industrial Electrician (Assistant) – Level 2	
Duration	12 months	
Sr. No.	**Name of Item/ Equipment / Tools**	**Quantity**
1.	AC & DC motors	
2.	AVO meter	
3.	Cable / wire gauge	
4.	Cable cutter	
5.	Cable knife	
6.	Circuit boards	
7.	Combination plier (set) electrically insulated	
8.	Drill	
9.	Continuity Tester	
10.	Earth tester	
11.	Earthing rod	
12.	Generator	
13.	Gloves	
14.	Goggles	
15.	Grinder	
16.	Growler	
17.	Hack saw	

18.	Hand saw	
19.	Helmet	
20.	Hole saw	
21.	Hydro meter	
22.	IR temperature gun	
23.	L scale	
24.	Lug punch	
25.	LUX meter	
26.	Corrugated sheet for wiring	
27.	Insulation Tester	
28.	Micrometer	
29.	Multi-meter	
30.	Electrician Cover all (Dangri)	
31.	Phase sequence meter	
32.	RPM meter	
33.	Safety belt	
34.	Set of nose pliers	
35.	Set of screw drivers	
36.	Electrical Safety Shoes	
37.	Thimble press pliers	
38.	Transformer 3- Phase /1- Phase up to 5 KVA Each	

39.	Vernier callipers	
40.	Welding plant	
41.	Pedestal Drill	
42.	Power factor Meter	
43.	Frequency Meter	
44.	Wattmeter	
45.	Phase Tester	
46.	Battery Charger	
47.	File Set	
48.	Adjustable Wrench	
49.	L Key set	
50.	Spanner set	
51.	Bench vice	
52.	Measuring Tape	

6. List of Consumable Supplies

Occupational title	Industrial Electrician (Assistant) – Level 2		
Duration	**12 months**		
Sr. No.	**Name of Item/ Equipment / Tools**	**Range**	**Quantity**
1.	Assorted Cables	3-.029 to 7-.076 Inch	
2.	Assorted Switches /Sockets	Light/Power	
3.	PVC Tape		
4.	PVC Conduit		
5.	PVC Duct		
6.	Magnetic Contactor		
7.	Over Load Relay		
8.	ON/Off Push Button		
9.	Timer		
10.	Assorted Switch Board		
11.	Emery paper		
12.	Assorted Thimbles		
13.	Assorted Connector Strips		
14.	Electrolyte		
15.	H^2SO^4		
16.	Lead Acid Battery		
17.	Dry Cell Battery		
18.	MCB,MCCB.		

19.	Cotton Gloves		
20.	Clean Cloth		
21.	Kerosene Oil		
22.	Wiring Clamps		

National Vocational & Technical Training Commission (NAVTTC)
5th Floor Evacuee Trust Complex Sector F-5/1,
Islamabad.
T +92 51 904404
F +92 51 904404
E info@navttc.org
I http://www.navttc.org/