

Curriculum For Electrical /Electronic Technician

(Certificate Level- 6 months)



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Overall objective of the course

Enable the trainees to perform routine skilled and semi-skilled tasks to carry out a variety of electrical/electronic installations & maintenance jobs and assist other team members in assigned preventive maintenance, installations, and repairs of electrical equipment, facilities and systems.

Competencies gained after completion of the course

The learner will gain competencies to:

- Carry out electrical/electronic Installations. (Industrial)
- Install industrial safety/ security and communication systems.
- Inspect, test, trace and repair faults in industrial electrical/electronic installations.
- Prepare estimates for Electrical/Electronic Installations.

Job Opportunities available immediately and in future

After completing this course, learner will have following career opportunities:

- Offer services as an electrician to an electrical shop, industry and to building contractors.
- Work as an Assistant Electrician in Public and Private Organizations.
- Seek employment in Industries (manufacture/assembly)
- Set up of his or her enterprise.
- Work as Contractor for Annual Maintenance/Repair of residential/ institutional/ commercial buildings.

Skill Standards

The certificate in the occupation of Electrical and Electronics Technician will be awarded to those who are competent in the following four units:

- Carry out Industrial electrical installations
- Install , service and repair/replace electrical control system and protective switch-gear
- Install industrial safety /security and communication System
- Prepare estimates for electrical installations

Overview about the program – Curriculum for Electrical /Electronic Technician

Module Title and Aim	Learning Units	Theory ¹ Days/hours	Workplace ² Days/hours
<p>Module 1: Electrical and Electronics Installations. (Industrial)</p> <p>Aim: This module covers the competencies required to install industrial electrical/electronic control & protective switchgear, lay conduits/ trunking/ ducts and wire single and multi phase circuit, install electrical/electronic accessories, fixtures and fittings using specified tools, equipment and material, according to electrical layout plans, conforming with standards & regulations for safety of the installation, while ensuring safety of self, others and property.</p>	<p>LU-1 Lay and Fix electrical conduits/ trunking/ ducts etc.</p> <p>LU-2 Install and wire main electrical /electronic control & protective switch gear.</p> <p>LU-3Wire electrical & electronics final circuits.</p> <p>LU-4 Install wiring for standby power supplies.</p>	80 hours	320 hours
<p>Module 2: Security and communication systems Installation.</p> <p>Aim: This module covers the competencies required to install and test industrial security and communication systems, using specified tools, test instruments and material, conforming to manufacturer's specifications, standards and regulation, while ensuring safety of self, others and property.</p>	<p>LU-1 Select the type of safety/ security and communication system appropriate for the purpose.</p> <p>LU-2 Install safety/ security and communication system.</p> <p>LU-3 Test and commission the system.</p>	80 hours	320 hours

<p>Module 3: Faults in electrical/electronic installations.</p> <p>Aim: This unit covers the competencies required to inspect and test industrial electrical/electronic installations after completion of the installations. Locate faults systematically according to regulations/ standards, using specified test instruments & repair. Carryout periodic test and maintain reports for safe and optimum performance of the electrical installation, while ensuring safety of self, others and property.</p>	<p>LU-1 Inspect the industrial electrical / electronic installations.</p> <p>LU-2 Test the electrical/electronic Installations.</p> <p>LU-3 Repair / maintain the electrical / electronic installations.</p>	<p>80 hours</p>	<p>320 hours</p>
<p>Module 4: Estimation for Installations.</p> <p>Aim: This module covers the competencies required to prepare estimates for industrial wiring and communication & safety equipment wiring in accordance with the layout plan/wiring diagrams etc., ensuring cost effectiveness, conforming to standards and regulations.</p>	<p>LU-1 Collect information for the Electrical Installation work.</p> <p>LU-2 Prepare estimate for the Installation.</p> <p>LU-3 Obtain customers' approval to commence the work.</p>	<p>80 hours</p>	<p>320 hours</p>

Electrical /Electronic Technician Curriculum Contents

Module 1 Title: Electrical and Electronics Installations

Objective of the Module: Building ability to carry out industrial electrical/electronic installations.

Duration: Total :400 hours **Theory:** 80hours **Practice:** 320 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
<p>LU 1- Lay and Fix electrical conduits/ trunking/ ducts etc.</p>	<p>Identify and mark Location of the electrical points according to layout plan.</p> <p>Mark Location & direction of conduit/ trunking/ ducts etc according to layout plan.</p> <p>Chip Walls where necessary, for the burying of conduit according to its sizes and number of runs.</p> <p>Select, prepare and fix Steel conduits, trunking/ ducts etc in pre-identified locations, clamped firmly, paying attention to the sizes and number of cables/wires to be accommodated according to the wiring diagrams/ regulation/standards.</p> <p>Burry / mount Conduit accessories</p>	<ul style="list-style-type: none"> • Interpret symbols used in a layout plan. • Differentiate between different views in a drawing. • Enlist different cable ways. • Distinguish between cable ways. • Name the tools used in chipping. • Identify the tools used for chipping. • Demonstrate skill by chipping on wall observing required Occupational Health and safety. • Demonstrate skills in making threads. • Demonstrate skills in cutting conduits. • Demonstrate skills to ensuring the firmness of conduit. • Select the appropriate accessories 	<p style="text-align: center;">100 hrs</p>	<ul style="list-style-type: none"> • Electrician's tool kit • Multimeter • Insulation Tester. • Earth fault loop impedance tester. • Earth electrode resistance tester. • Prospective short circuit current tester. • Prospective earth fault current tester. • Draw wire. • Personal protective equipment. 	<p style="text-align: center;">Class Room and work place both are used for learning.</p>

	firmly at pre-identified feasible locations, according to lay out plan, at specified depths and heights for each electrical point in conformity with regulations/ standards.	<ul style="list-style-type: none"> used in fixing conduits. Demonstrate skills in safe working at heights. 			
LU 2- Install and wire main electrical /electronic control & protective switch gear.	<p>Fix / mount Main power control switchgear at the location according to the layout plan /diagram.</p> <p>Install Standby power supply equipment and change-over switchgear as per manufacturer's specifications.</p> <p>Lay and terminate Cables from the main power control switchgear and power change-over switchgear to the main power supply / transformers as specified in the layout plan/ regulations/ standards.</p> <p>Install Earthing system and terminate at the pre-identified locations, in accordance with layout plan and conforming to regulations and standards.</p>	<ul style="list-style-type: none"> Describe applications of various types of switch gears. Identify symbols used for switchgears. Interpret some given lay out plan. Install Main power Control switchgear according to layout. Explain the operation of change over system. Draw Block diagram of the change over system. Interpret Schematic/circuit diagram of the change over system. Install Standby power supply Explain the use of transformer Differentiate between star delta connections. List and describe classes of terminations or connections used in the electrical trade. Demonstrate skill in cable termination. Describe the purpose of earthing. Identify locations of earthing in given layout plan. Installing system according to lay out plan. 	100 hrs	<ul style="list-style-type: none"> Electrician's tool kit Multimeter Insulation Resistance Tester. Earth fault loop impedance tester. Earth electrode resistance tester. Prospective short circuit current tester. Prospective earth fault current tester. Draw wire. Personal protective equipment. 	Class Room and work place both are used for learning.

<p>LU 3- Wire electrical & electronics final circuits.</p>	<p>Select Types and size of wires and cables for each final circuit referring to the wiring diagram / standards.</p> <p>Carryout Wiring in accordance with the wiring diagram / layout plan and in conformity with standards and regulations.</p> <p>Mount Electrical/ electronic accessories in the final circuit and terminate wires as per wiring diagrams.</p> <p>Carryout special wiring for construction sites, temporary buildings, and agricultural sites according to regulation and standards.</p> <p>Carry out Electrical/Electronic installations in hazardous areas according to regulations and standards.</p> <p>Fix Electrical / electronic appliances,</p>	<ul style="list-style-type: none"> • State the types of conductors. • Enlist types of insulators • Determine the AWG wire size with a wire gauge. • Calculate the cross-sectional area of conductors. • Select wire size as per required load <ul style="list-style-type: none"> • Demonstrate skill in interpreting wiring diagrams. • Carry out wiring according to lay out plan <ul style="list-style-type: none"> • Demonstrate the skills used for the stripping, • Demonstrate the skills used for Tagging • Demonstrate the skills used for terminating conductors. <ul style="list-style-type: none"> • Describe the conditions for use of exposed wiring located outdoors. • Describe the conditions for use of raceways in general. <ul style="list-style-type: none"> • Describe the regulations for hazardous areas installations. <ul style="list-style-type: none"> • Determine the location of various appliances, equipments. 	<p>100 hrs</p>	<ul style="list-style-type: none"> • Electrician's tool kit • Multimeter • Insulation Tester. • Earth fault loop impedance tester. • Earth electrode resistance tester. • Prospective short circuit current tester. • Prospective earth fault current tester. • Draw wire. • Personal protective equipment. 	<p>Class Room and work place both are used for learning.</p>
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	equipment in the final circuits according to the wiring diagram/standards.	<ul style="list-style-type: none"> • Demonstrate skills in fixing various appliances, equipments. • Demonstrate skills in wiring various appliances, equipments. 			
LU 4- Install wiring for standby power supplies.	<p>Install Trunking / conduit/ duct etc for laying of power cables according to wiring diagrams.</p> <p>Earth the standby power supply as per manufacturer Specifications.</p> <p>Install power change over Power changeover switchgear / control and protective switchgear required for the standby power supply and lay & terminate cables as per manufacturer's specifications/ regulations/standards.</p> <p>Check Power change over system for correct phase sequence and performance.</p>	<ul style="list-style-type: none"> • Determine the number and color of power cables and their route. • Fix the raceways required. • Demonstrate skills in earthling as per manufacture's specifications and reregulation • Draw block diagram of standby power Supply system. • Demonstrate installation Referring to Installation manuals of standby power system manuals • Describe phase sequence significance. • Demonstrate use of phase sequence tester. 	100 hrs	<ul style="list-style-type: none"> • Electrician's tool kit • Multimeter • Insulation Tester. • Earth fault loop impedance tester. • Earth electrode resistance tester. • Prospective short circuit current tester. • Prospective earth fault current tester. • Draw wire. • Personal protective equipment. 	Class Room and work place both are used for learning.

Module 2 Title: Safety/security and communication systems Installation

Objective of the Module: Building ability to Install industrial Safety/ security and communication systems.

Duration: Total :400 hours **Theory:** 80hours **Practice:** 320 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
<p>LU 1- Identify the type of safety/ security and communication system appropriate for the purpose.</p>	<p>Inspect the premises where the system is to be installed, gather client or user requirement</p> <p>Identify the appropriate safety / security/ communication system considering the practicality of the system, cost and client/ user's requirements.</p>	<ul style="list-style-type: none"> • Describe the components in a security system. • Describe the components in a communication system. • Determine suitable locations for a given system's components. • Describe the types of security systems. • Describe the types of communication systems. • Select appropriate system for a given capacity and premises requirements. 	<p>150 hrs</p>	<ul style="list-style-type: none"> • Electrical/electronic tool kit • Multimeter • Insulation Resistance Tester. • Special testing instruments specified by the manufacturer • Wires and cables. • Electrical accessories. • Material require for the 	<p>Class Room and work place both are used for learning.</p>
<p>LU 2- Install safety/ security and communication system.</p>	<p>Select Tools test instrument & material as needed for the work.</p> <p>Select conduits/ trunking, cables, wire & switchgear and accessories according to the requirements.</p>	<ul style="list-style-type: none"> • Enlist the tools/test instruments used in installation of communication systems. • Describe the use of the tools/test instruments in installation of communication systems. • Explain the criteria for selection of following: <ul style="list-style-type: none"> i. Conduits. ii. Cables. iii. Switchgears. 	<p>100 hrs</p>	<ul style="list-style-type: none"> • Electrical/electronic tool kit • Multimeter • Insulation Resistance Tester. • Special testing instruments specified by the manufacturer • Wires and cables. • Electrical accessories. • Material require for the 	<p>Class Room and work place both are used for learning.</p>

	<p>Mark location for units. Lay/Fix conduits/ casing and capping according to the wiring diagram avoiding possible electrical interference on other systems.</p> <p>Draw wires/ cables to each unit according to wiring diagram.</p> <p>Mount units at the specified locations as per manufacturer's specifications and considering customer's/ client's requirements</p> <p>Install standby power back up system as applicable.</p> <p>Mount component of the system at specific locations according to manufacturer's instructions and customer's requirements.</p>	<ul style="list-style-type: none"> • Demonstrate skills in : <ul style="list-style-type: none"> i. Marking ii. Fixing conduits. iii. Casing and capping. • Explain the electrical interference phenomenon. • Explain the codes used in wiring communication cables. • Demonstrate skills for cable laying through conduits • List the accessories used in fixing different units. • Demonstrate skills in units mounting • Draw block diagram for power backup system. • Demonstrate skills in power backup installation • List the accessories used in fixing different components. • Demonstrate skills in Components mounting 		<p>installation.</p> <ul style="list-style-type: none"> • Personal protective equipment. 	
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<p>LU 3- Test and commission the systems.</p>	<p>Connect the system up to the power source as recommended by the manufacturer.</p> <p>Adjust settings, directions where necessary for correct functioning of units in the system.</p> <p>Check the standby power backup for its functioning.</p> <p>Test and commission the system.</p> <p>Inform the client /user on the operating procedure and periodic testing of the system.</p>	<ul style="list-style-type: none"> • Demonstrate proper connection methods for communication cables. • Explain the function of different units. • Demonstrate operation of different units. • Explain importance of backup system. • Report the status of backup system. • Explain the procedures used in testing a communication system. • Produce Report. • Demonstrate professional behavior with customer. • Demonstrate operation of system. • Enlist different tests and their periods. 	<p>150 hrs</p>		
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Module 3 Title: Troubleshooting in electrical/electronic installations.

Objective of the Module: Building ability to inspect, test, and trouble shoot in industrial electrical/electronic installations

Duration: Total :400 hours **Theory:** 80hours **Practice:** 320 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
<p>LU 1- Inspect the industrial electrical / electronic installations.</p>	<p>Check the installation visually for general compliance with the standards & regulations and referring to lay out plans.</p> <p>Inspect the electrical /electronic installations for defects and damages.</p> <p>Check switchgears for Damages</p> <p>Check Protective devices and accessories for damages</p>	<ul style="list-style-type: none"> • Demonstrate skills in interpreting layout drawings. • Explain characteristics of a proper installation. • Prepare inspection report on prescribed Performa. • Describe the Possible defects in electrical/ electronic installations. • Identify defective Parts. • Report the damages for switchgears. • Describe different types of protective devices and their use in protection circuits. • Identify deviations from the layout plan 	<p>100 hrs</p>	<ul style="list-style-type: none"> • Electrician's tool kit • Multimeter • Insulation Tester. • Earth fault loop impedance tester. 	<p>Class Room and work place both are used for learning.</p>

<p>LU 2- Test the electrical/ electronic Installations</p>	<p>Carry out the following tests using specified electrical test instrument in conformity with regulations and standards and observing safety precautions;</p> <ul style="list-style-type: none"> - Conductor continuity - Polarity - Phase sequence - Insulation resistance - Earth resistance - Earth fault loop impedance - Prospective over current/ short circuit current & voltage. <p>Test the installation for its working, locate faults and note down & prepare reports.</p>	<ul style="list-style-type: none"> • Perform following tests: <ul style="list-style-type: none"> - Conductor continuity - Polarity - Phase sequence - Insulation resistance - Earth electrode resistance - Earth fault loop impedance - Prospective over current/ short circuit current & voltage. • Describe the information deduct from above tests. • Prepare report on prescribed Performa. 	<p>100 s</p>	<ul style="list-style-type: none"> • Earth electrode resistance tester. • Prospective short circuit current tester. • Prospective earth fault current tester. • Clip-on meter 	
<p>LU 3- Repair / maintain the electrical / electronic installation.</p>	<p>Enlist the Necessary adjustments in the control protective and monitoring switchgear attended to.</p> <p>Prepare list of items/material required for replacement and obtain them.</p> <p>Service/Repair/ replace defective control & protective switchgear, damaged wire/ cable, damaged defective lamps/fixtures/fittings electrical accessories, earth electrode & faulty/ damaged earth conductors.</p> <p>Repair / or replace Electrical supply to the communication devices.</p>	<ul style="list-style-type: none"> • Describe common type of faults and their remedy. • Describe types of industrial (electrical) accessories and their application on industrial electrical installations. • Describe operation of different types of Switch gears. • Demonstrate skills in repairing for assigned task • Explain types of wires and accessories used in supply system of communication devices. 	<p>200 hrs</p>		

Module 4 Title: Estimation for Installation.

Objective of the Module: Building ability to prepare estimate for electrical/electronic installations.

Duration: Total :400 hours **Theory:** 80hours **Practice:** 320 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1- Collect information for the Electrical Installation work.	<p>Gather Information from the customer.</p> <p>Enlist the Material required for the Installation work, considering the customer's needs.</p> <p>Obtain and compare current market prices of material, goods and switch gear of appropriate quality from several suppliers.</p> <p>Estimate Labor requirements for installation.</p>	<ul style="list-style-type: none"> • Enlist the items to be asked from the customer. • Demonstrate professional behavior with the customer. • Prepare list of materials referring to the given layout plan/wiring diagram. • Demonstrate proper measuring procedures. • Write a letter to supplier to obtain prices. • Prepare comparative statement • Determine number of Laborer for said task. 	<p>150 hrs</p>	<ul style="list-style-type: none"> • Measuring tape • Calculator. • Stationary. • Layout plans • Relevant Data. • Manufacturer's specs. 	<p>Class Room and work place both are used for learning.</p>

<p>LU 2- Prepare estimate for the Installation.</p>	<p>Calculate Cost of material & accessories in terms of current market prices.</p> <p>Calculate No of labor hours & its cost according to current labor rates/company or enterprise policies.</p> <p>Calculate Transport/overhead costs according to company policies.</p> <p>Calculate Profit margin, considering the total cost involved and company policies.</p> <p>Calculate Cost of contingencies on average basis.</p> <p>Calculate and prepare document of Total estimate.</p>	<ul style="list-style-type: none"> • Calculate cost of materials when the price and quantities are given. • Calculate No of labor hours for a given task. • Calculate cost when rates are given. • Calculate Transport/overhead costs for a given task. • Calculate Profit margin, for a given criteria. • Enlist the contingencies required to perform a given task. • Prepare document of total cost for a given task. 	<p>150 hrs</p>	<ul style="list-style-type: none"> • Measuring tape • Calculator. • Stationary. • Layout plans • Relevant Data. • Manufacturer's specs. 	<p>Class Room and work place both are used for learning.</p>
<p>LU 3- Obtain customers approval to commence the work.</p>	<p>Present Estimate to the customer in a standard format.</p> <p>Understand customer 's feedback</p> <p>Make adjustments in estimate to accommodate customer's feedback and obtain approval.</p>	<ul style="list-style-type: none"> • Prepare a format to present estimate to customer. • Demonstrate how he would take feedback • Accommodate some changes given by assessors. 	<p>100 hrs</p>	<ul style="list-style-type: none"> • Measuring tape • Calculator. • Stationary. • Layout plans • Relevant Data. • Manufacturer's specs. 	<p>Class Room and work place both are used for learning.</p>

Electrical /Electronic Technician Curriculum Assessment

Module 1 Title: Electrical and Electronics Installations

Objective of the Module: Building ability to carry out industrial electrical/electronic installations.

Duration: Total :400 hours **Theory:** 80hours **Practice:** 320 hours

Learning Units	Theory Days/hours	Workplace Days/hours	Recommended formative assessment	Recommended Methodology	Scheduled Dates
M1-LU1 Lay and Fix electrical conduits/ trunking/ ducts etc.	20 hours	80 hours	<ul style="list-style-type: none"> • Interpret symbols used in a layout plan. • Differentiate between different views in a drawing. • Enlist different cable ways. • Distinguish between cable ways. • Name the tools used in chipping. • Identify the tools used for chipping. • Demonstrate skill by chipping on wall observing required Occupational Health and safety. • Demonstrate skills in making threads. • Demonstrate skills in cutting conduits. • Demonstrate skills to ensuring the firmness of conduit. • Select the appropriate accessories used in fixing conduits. • Demonstrate skills in safe working at heights. 	<ul style="list-style-type: none"> • Paper based Test • Oral • Report • oral • Demonstration 	To be considered

<p>M1-LU2 Install and wire main electrical /electronic control & protective switch gear.</p>	<p>20 hours</p>	<p>80 hours</p>	<ul style="list-style-type: none"> • Describe applications of various types of switch gears. • Identify symbols used for switchgears. • Interpret given lay out plan. • Install Main power Control switchgear according to layout. • Explain the operation of change over system. • Draw Block diagram of the change over system. • Interpret Schematic/circuit diagram of the change over system. • Install Standby power supply • Explain the use of transformer • Differentiate between star delta connections. • List and describe classes of terminations or connections used in the electrical trade. • Demonstrate skill in cable termination. • Describe the purpose of earthing. • Identify locations of earthing in given layout plan. • Install system according to lay out plan. 	<ul style="list-style-type: none"> • Work/product samples • Paper based Test • Oral • Report • Demonstration 	
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<p>M1-LU3 Wire electrical & electronics final circuits.</p>	<p>20 hours</p>	<p>80 hours</p>	<ul style="list-style-type: none"> • State the types of conductors. • Enlist types of insulators • Determine the AWG wire size with a wire gauge. • Calculate the cross-sectional area of conductors. • Select wire size as per required load • Demonstrate skill in interpreting wiring diagrams. • Carry out wiring according to lay out plan • Demonstrate the skills used for the stripping, • Demonstrate the skills used for Tagging • Demonstrate the skills used for terminating conductors. • Describe the conditions for use of exposed wiring located outdoors. • Describe the conditions for use of raceways in general. • Describe the regulations for hazardous areas installations • Determine the location of various appliances and equipment. • Demonstrate skills in fixing various appliances, equipment. • Demonstrate skills in wiring various appliances and equipment. 	<ul style="list-style-type: none"> • Work/product samples • Paper based Test • Oral • Report • Demonstration 	
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<p>M1-LU4 Install wiring for standby power supplies.</p>	<p>20 hours</p>	<p>80 hours</p>	<ul style="list-style-type: none"> • Determine the number and color of power cables and their route. • Fix the raceways required. • Demonstrate skills in earthing as per manufacture's specifications and reregulation • Draw block diagram of standby power Supply system. • Demonstrate installation Referring to Installation manuals of standby power system manuals • Describe phase sequence significance. • Demonstrate use of phase sequence tester. 	<ul style="list-style-type: none"> • Work/product samples • Paper based Test • Oral • Report • Demonstration 	
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Supportive notes

- Assessment context

- This module could be assessed on or off the job or in a simulated situation
- Candidate must demonstrate the competencies in this unit individually
- This unit could be assessed individually or in conjunction with other related units.
- In this unit preparation of estimates are limited to the following:
 - Domestic/Industrial electrical new installations.
 - Repairs/alterations/additions to existing domestic/ industrial electrical installations, 3-phase, 400 V, 60 Amps.

- Critical aspects

Assessment must confirm the candidate's ability to:

- Identify customer's /client's requirements and prepare estimate referring to layout plans.
- Use of current market prices of electrical switchgear, accessories and material.
- Prepare the list of material.

- Assessment condition

The candidate will have access to:

- Current market prices of items needed.
- Information on current labor rates/ overhead costs/taxes/ exchange rates, where applicable.
- Stationary and documentary material required for preparation of estimates, etc.

The candidate will be permitted to refer to the following documents:

- Relevant product and manufacturing specifications.
- Relevant manuals, standards and reference materials.

The candidate will be required to:

- Orally or by other methods of communication, answer questions asked by the assessors.
- Identify superiors who can be approached for the collection of competency evidence where appropriate.
- Present evidence of credit for any off-job training related to this unit.

Assessors must be satisfied that the candidate can competently perform all elements of the unit as specified by the criteria, and that he / she possess the required underpinning knowledge.

- Resources required for assessment

All tools and stationary and relevant information/ data on present market prices of material listed under the range statement for the unit.

Module 2 Title: Safety/security and communication systems Installation

Objective of the Module: Building ability to Install industrial Safety/ security and communication systems.

Duration: Total :400 hours **Theory:** 80hours **Practice:** 320 hours

Learning Units	Theory Days/hours	Workplace Days/hours	Recommended formative assessment	Recommended Methodology	Scheduled Dates
<p>M2-LU1 Identify the type of safety/ security and communication system appropriate for the purpose.</p>	<p>30 hours</p>	<p>120 hours</p>	<ul style="list-style-type: none"> • Describe the components in a security system. • Describe the components in a communication system. • Demonstrate suitable locations selection for a given system components. • Describe the various types of security systems. • Describe the various types of communication systems. • Select most appropriate system for a given capacity and premises requirements. 	<ul style="list-style-type: none"> • Paper based Test • Oral • Report • Demonstration 	<p>To be considered</p>

<p>M2-LU2 Install safety/ security and communication system.</p>	<p>20 hours</p>	<p>80 hours</p>	<ul style="list-style-type: none"> • Enlist the tools/test instruments used in installation of communication systems. • Describe the use of the tools/test instruments in installation of communication systems. • Explain the criteria for selection of following: <ul style="list-style-type: none"> • Conduit. • Cables. • Switchgears. • Demonstrate skills in : <ul style="list-style-type: none"> • Marking • Fixing conduits. • Casing and capping. • Explain the electrical interference phenomenon. • Explain the codes used in wiring communication cables. • Demonstrate skills for cable laying through conduits • Enlist the accessories used in fixing different units. • Demonstrate skills in units mounting • Draw block diagram for power backup system. • Demonstrate skills in power backup installation • Enlist the accessories used in fixing different components. • Demonstrate skills in Components mounting 	<ul style="list-style-type: none"> • Paper based Test • Oral • Report • Demonstration • Work/product samples 	
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M2-LU3 Test and commission the system.	30 hours	120 hours	<ul style="list-style-type: none"> • Demonstrate proper connection methods for communication cables. • Explain the function of different units. • Demonstrate operation of different units. • Explain the importance of backup system. • Report the status of backup system. • Explain the procedures used in testing a communication system. • Produce Report. • Demonstrate professional behavior with customer. • Explain the procedures used in testing a communication system. • Demonstrate professional behavior with customer. • Enlist the different test and their periods. 	<ul style="list-style-type: none"> • Work/product samples • Paper based Test • Oral • Demonstration. 	
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Supportive notes

- **Assessment context**

This module could be assessed on the job or in a simulated environment demonstrated by an individual working alone or as a part of a team.

This unit could be assessed individually or in conjunction with other related units.

Work may take place in a construction worksite or in an industrial/commercial building where the electrician is called to perform the job.

Industrial electrical wiring circuits include:

- Lighting circuits
- Circuits for fixed electrical equipment/appliances
- Circuits for industrial socket outlets
- Circuits for special locations and hazardous areas.
- Circuits for standby Power supply.
- Ring & radial Circuits for sockets outlets
- Circuits for high current rated electrical machinery and equipment.

- **Critical aspects**

Assessment must confirm the candidate's ability to:

- Observe safety of self, others and property.
- Apply regulations and standards.

- **Assessment condition**

The candidate will have access to:

- Current market prices of items needed.
- Information on current labor rates/ overhead costs/taxes/ exchange rates, where applicable.
- Stationary and documentary material required for preparation of estimates, etc.

The candidate will be permitted to refer to the following documents:

- Relevant product and manufacturing specifications.
- Relevant manuals, standards and reference materials.

The candidate will be required to:

- Orally or by other methods of communication, answer questions asked by the assessors.
- Identify superiors who can be approached for the collection of competency evidence where appropriate.
- Present evidence of credit for any off-job training related to this unit.

Assessors must be satisfied that the candidate can competently perform all elements of the unit as specified by the criteria, and that he / she possess the required underpinning knowledge.

- **Resources required for assessment**

All tools, equipment, machines and material listed under the range statement for the unit.

Module 3 Title: Troubleshooting in electrical/electronic installations.

Objective of the Module: Building ability to inspect, test, and trouble shoot in industrial electrical/electronic installations

Duration: Total :400 hours **Theory:** 80hours **Practice:** 320 hours

Learning Units	Theory Days/hours	Workplace Days/hours	Recommended formative assessment	Recommended Methodology	Scheduled Dates
M3-LU1 Inspect the industrial electrical / electronic installations	20 hours	80 hours	<ul style="list-style-type: none"> • Demonstrate skills in interpreting layout drawings. • Explain characteristics of a proper installation. • Prepare inspection report on prescribed Performa. • Describe possible defects in electrical/ electronic installations. • Identify defective Parts. • Report the damages for switchgears. • Describe different types of protective devices and their use in protection circuits. • Identify deviations from the layout plan 	<ul style="list-style-type: none"> • Paper based Test • Oral • Report • Demonstration 	

M3-LU2 Test the electrical /electronic Installations	20 hours	80 hours	<ul style="list-style-type: none"> • Perform following tests: <ul style="list-style-type: none"> - Conductor continuity - Polarity - Phase sequence - Insulation resistance - Earth electrode resistance - Earth fault loop impedance - Prospective over current/ short circuit current & voltage. • Describe the information deducted from above tests. • Prepare report on prescribed Performa. 	<ul style="list-style-type: none"> • Paper based Test • Oral • Report • Demonstration 	
M3-LU3 Repair / maintain the electrical / electronic installation	40 hours	160 hours	<ul style="list-style-type: none"> • Describe common type of faults and their remedies. • Describe types of industrial (electrical) accessories and their application on industrial electrical installations. • Describe operation of different types of Switch gears. • Demonstrate skills in repairing for assigned task • Explain types of wires and accessories used in supply system of communication devices. • Explain types of wires and accessories used in supply system of communication devices. 	<ul style="list-style-type: none"> • Paper based Test • Oral • Report • Demonstration 	

Supportive notes

- Assessment context

This module could be assessed on the job demonstrated by an individual working alone or as a part of a team.

This unit could be assessed individually or in conjunction with other related units.

Work may take place in a construction worksite or in an industrial/commercial building where the electrician is called to perform the job.

Industrial safety/ security and communication systems in this unit include:

- Fire alarm systems.
 - Public address systems.
 - Intercom systems.
 - Up down counting systems etc.
 - Burglar alarm systems.
 - Time card/master clock systems
 - Security camera systems
- **Critical aspects**
Assessment must confirm the candidate's ability to:
 - Use electrical/electronic test and measuring instruments correctly and safely.
 - Install and test the system in sequential order and as per manufacturer's instructions.
 - Ensure proper functioning of the system and non interference of the system with the working of other systems.

- **Assessment condition**
The candidate will have access to:
 - All tools, equipment, material and documentation required.

The candidate will be permitted to refer to the following documents:

- Relevant workplace procedures.
- Relevant product and manufacturing specifications.
- Relevant drawings, manuals, codes, standards and reference materials.

The candidate will be required to:

- Orally or by other methods of communication, answer questions asked by the assessors.
- Identify superiors who can be approached for the collection of competency evidence where appropriate.
- Present evidence of credit for any off-job training related to this unit.

Assessors must be satisfied that the candidate can competently perform all elements of the unit as specified by the criteria, and that he she possess the required underpinning knowledge.

- **Resources required for assessment**
All tools, equipment, machines and material listed under the range statement for the unit.

Module 4 Title: Estimation for Installation.

Objective of the Module: Building ability to prepare estimate for electrical/electronic installations.

Duration: Total :400 hours **Theory:** 80hours **Practice:** 320 hours

Learning Units	Theory Days/hours	Workplace Days/hours	Recommended formative assessment	Recommended Methodology	Scheduled Dates
M4-LU1 Collect information for the Electrical Installation work.	30 hours	120 hours	<ul style="list-style-type: none"> • Enlist the items to be asked from the customer. • Demonstrate professional behavior with the customer. • Prepare list of materials referring to the given layout plan/wiring diagram. • Demonstrate proper measuring procedures. • Write a letter to supplier to obtain prices. • Prepare comparative statement of different suppliers. • Determine number of Labor for some given tasks. 	<ul style="list-style-type: none"> • Paper based tests. • Presentation in a Simulated environment • Demonstration 	To be considered
M4-LU2 Prepare estimate for the Installation	30 hours	120 hours	<ul style="list-style-type: none"> • Calculate cost of materials when the price and quantities are given. • Calculate No. of labor hours for a given task. • Calculate cost when rates are given. • Calculate Transport/overhead costs for a given task. • Calculate Profit margin, for a given criteria. • Enlist the contingencies required to perform a given task. • Prepare document of total cost for a given task. 	<ul style="list-style-type: none"> • Paper based tests. 	
M4-LU3 Obtain customers approval to commence the work.	20 hours	80 hours	<ul style="list-style-type: none"> • Prepare a format to present estimate to customer. • Demonstrate how he would take feedback • Accommodate some changes given by assessors. 	<ul style="list-style-type: none"> • Paper based tests. • Demonstration • Presentation 	

Supportive notes

- **Assessment context**

This module could be assessed on the job or in a simulated environment demonstrated by an individual working alone or as a part of a team.

This unit could be assessed individually or in conjunction with other related units.

Work may take place in a construction worksite or in an industrial/commercial building where the electrician is called to perform the job.

Inspection, testing & Fault rectification in this unit includes:

- Overall tests on industrial electrical installations soon after completion of the installation.
- Periodic inspection & testing on existing industrial electrical installations.
- Repairs/ replacements of defective components.

- **Critical aspects**

Assessment must confirm the candidate's ability to:

- Carry out inspection, testing, installation and fault finding safely and in sequential order.
- Adhere to safe work practices and use personal protective equipment.
- Carry out replacements according to manufacturer's requirements

- **Assessment condition**

The candidate will have access to:

- All tools, equipment, material and documentation required.

The candidate will be permitted to refer to the following documents:

- Relevant workplace procedures.
- Relevant product and manufacturing specifications.
- Relevant drawings, manuals, codes, standards and reference materials.

The candidate will be required to:

- Orally or by other methods of communication, answer questions asked by the assessors.
- Identify superiors who can be approached for the collection of competency evidence where appropriate.
- Present evidence of credit for any off-job training related to this unit.

Assessors must be satisfied that the candidate can competently perform all elements of the unit as specified by the criteria, and that he/she possess the required underpinning knowledge.

- **Resources required for assessment**

All tools, equipment, machines and material listed under the range statement for the unit.

List of Tools / Equipments / Machinery

(For a class of 20 students)

Sr. No.	Name of Tools / Equipment	Quantity
1.	Wire stripper	5 Nos
2.	Screw Driver 4", 6", 8"	25 Nos each
3.	Neon phase tester light duty pocket size	25 Nos
4.	Insulated pliers with side cutter	20 Nos
5.	Insulated long nose pliers with side cutter	20 Nos
6.	Insulated wire cutter	20 Nos
7.	High insulation rubber hand gloves	20 Nos
8.	Knife	20 Nos
9.	Chisels 6", 12"	10 Nos each
10.	Hammers 200 grm.	20 Nos
11.	Hack saws	20 Nos
12.	Electric soldering iron 150 watt	10 Nos
13.	Philips screw driver No 1, 2, 3.	20 Nos each
14.	Measuring tap 3m	20 Nos
15.	Steel foot rule.	20 Nos
16.	Files (Flat) 250 x 1, 200 x 2	20 Nos each
17.	Files (Triangular) 150 x 2	20 Nos
18.	Files (Half round) 200 x 2	20 Nos

19.	Files (Round) 200 x 1	20 Nos
20.	Files (Raps cut) 150	20 Nos
21.	Bench Vice 5"	20 Nos
22.	Tri square 150 x 100 mm	20 Nos
23.	Vernier caliper 150 mm	20 Nos
24.	Center punch	20 Nos
25.	Hammer 500 gm	10 Nos
26.	Scriber	20 Nos
27.	Rubber hammer	10 Nos
28.	Vice clamps	20 Nos
29.	Insulation Remover 150 mm	20 Nos
30.	Bearing puller	2 Nos
31.	Farmer chisels 8".	10 Nos
32.	Wooden saw 300 mm	10 Nos
33.	Test boy	20 Nos
34.	Volt meter (Panel type 4" x 4") 0-300V-AC 50 HZ	10 Nos
35.	Volt meter (Panel type 4" x 4") 0-600V-AC 50 HZ	
36.	Ammeter (Panel type 4" x 4") 0-30-AC 50 HZ	20 Nos
37.	Multi-meter (Digital)	10 Nos
38.	Multi-meter (Analog)	06 Nos
39.	Tong tester	20 Nos
40.	Hand Electric drill machine with hammering 0-13 mm	6 Nos
41.	Pedestal drill machine	2 Nos

42.	Jigsaw machine portable	1 No
43.	Scissor 6"	5 Nos
44.	Single phase energy meter 220V /10-20A	5 Nos
45.	Three phase energy meter 30 A	5 Nos
46.	Dust brush / File brush	20 Nos each
47.	Magnetic Contactors 2 + 2 220 Volts / 10 A 50Hz	10 Nos.
48.	Single Phase Motor 220 Volts 50Hz ½ HP	5 Nos.
49.	Three Phase Motor 380 Volts 50Hz 2 HP	5 Nos.
50.	Push Button Single Way / Two Way / Three Way	20 Nos. Each
51.	Drum Switch ON / OFF, REV / FOR, Star / Delta	10 Nos. Each
52.	Overload Relay 0.5 – 3.0 Amp	20 Nos.
53.	Motor Protection Switch Three Phase	10 Nos.
54.	Earth Resistance Tester	5 Nos
55.	Oscilloscope 40 MHz	2 Nos
56.	Function Generator 5 MHz	2 Nos
57.	Variable Power Supply 0-24V, 5A	5 Nos
58.	Variac 440 3 phase	2 Nos
59.	RLC Tester	2 Nos
60.	UPS 1 kW	5 Nos
61.	Security Camera	2 Nos
62.	Computer System	2 Nos
63.	Adjustable ladder, 6 Ft	2 Nos
64.	Power factor meter	2 Nos

Qualification of Instructor

DAE in Electrical / Electronic with 3 Years relevant experience

OR

2 Years Trade Proficiency Certificate with 6 Years relevant experience

Names of National Curriculum Review Committee Members

- Engr. Abdul Maqsood, Principal GPI, Mardan.
- Engr. Shahbaz Hussain, Chief Instructor, Government Swedish-Pak College of Technology, Gujrat
- Manzoor Ahmed Rahi, Instructor, TTC, Quetta.
- Mrs. Durr-e-Shahwaar, Lecturer, GCT(W), Karimabad, Karachi
- Mr. Naeem Ahmed, Senior Instructor, Trade Testing Board, Alhyderi, Karachi
- Mr. Muhammad Khalid, Senior Instructor, VTI, Korangi, Karachi
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