



**Tertiary and Vocational Education Commission**

**National Competency Standards and Curriculum**

**For**

**Electrician (Industrial)-NVQ Level 4  
(E40S008)**

<b>Electrician–Level 4</b>		
<b>Module no.</b>	<b>Module Title</b>	<b>Duration</b>
<b>01</b>	<b>Occupational Health and Safety</b>	<b>30</b>
<b>02</b>	<b>Workshop practice</b>	<b>30</b>
<b>03</b>	<b>Principles of Electricity</b>	<b>120</b>
<b>04</b>	<b>Draw wiring diagrams</b>	<b>60</b>
<b>05</b>	<b>Make L.T Electric cables joints</b>	<b>30</b>
<b>06</b>	<b>Carry out electrical Installation in buildings</b>	<b>250</b>
<b>07</b>	<b>Carry out industrial electrical Installation</b>	<b>200</b>
<b>08</b>	<b>Assemble LV distribution board</b>	<b>90</b>
<b>09</b>	<b>Install, Repair and Maintain Electrical Control Circuits &amp; Equipment</b>	<b>200</b>
<b>10</b>	<b>Repair &amp; Maintain Electrical Equipment</b>	<b>48</b>
<b>11</b>	<b>Repair and Maintain Electric Motors</b>	<b>60</b>
<b>12</b>	<b>Maintain Standby Generators</b>	<b>30</b>
<b>13</b>	<b>Carry out commissioning and maintaining of electrical installations</b>	<b>30</b>
<b>14</b>	<b>Prepare cost estimate</b>	<b>24</b>
<b>15</b>	<b>Install and Maintain Programmable Logic Controllers</b>	<b>120</b>
<b>16</b>	<b>Building career skills 2</b>	<b>120</b>
		<b>1442</b>

## Electrician–Level 4

<b>Module Title and Code:</b>	<b>Module 01: Occupational Health and Safety</b>
<b>Reference to NCS:</b>	See Competency Profile
<b>Competencies (job functions and soft skills) and descriptions:</b>  At the end of this module student should be able to <ol style="list-style-type: none"><li>1. Use appropriate Personnel Protective Equipment(PPE)</li><li>2. Apply prevention methods from electric shock</li><li>3. Practice first aid</li><li>4. Demonstrate the use of fire extinguishers</li></ol>	
<b>Typical related work situations to master :</b> <ul style="list-style-type: none"><li>• Use of appropriate PPE</li><li>• Adhere to safety practices, rules and regulations</li></ul>	
<b>Important pertinent Content (knowledge):</b>	<ul style="list-style-type: none"><li>• Personnel Protective Equipment(PPE)</li><li>• Safety tools, testing equipment and tools</li><li>• Electric shock<ul style="list-style-type: none"><li>➢ Safety Extra Low Voltage (SELV)</li><li>➢ Safety Low Voltage (SLV)</li><li>➢ Phase and neutral</li><li>➢ Operational Principle of neon tester</li></ul></li><li>• Prevention from electric shock<ul style="list-style-type: none"><li>➢ Isolation and locking</li><li>➢ Display notices</li></ul></li><li>• Importance of earthing</li><li>• Handle emergency situations</li><li>• First aid<ul style="list-style-type: none"><li>➢ related to electric shock</li><li>➢ related to work place accidents</li><li>➢ related to fire</li></ul></li><li>• Prepare workplace to minimize accidents</li><li>• Safety sign boards, colors and symbols</li><li>• Classification of fire and fire protection</li><li>• Selection of fire extinguishers and firefighting methods</li><li>• Operation of safety equipment</li><li>• Rules and regulations related to work place safety</li><li>• Lifting methods</li><li>• Use of ladders/scaffolding</li></ul>

**Potentially useful teaching methods (optional):**

- Demonstrations
- Role plays
- Lectures
- Guided practice
- Video shows
- Assignments
- Projects

## Electrician–Level 4

<b>Module Title and Code:</b>	<b>Module 2: Workshop practice</b> <b>Time Frame: 30hrs</b>
<b>Reference to NCS:</b>	See Competency Profile
<b>Competencies (job functions and soft skills) and descriptions:</b>  At the end of this module student should be able to <ol style="list-style-type: none"><li>1. Measure and mark work pieces</li><li>2. Cut work pieces</li><li>3. File work pieces</li><li>4. Grind work pieces</li><li>5. Bore holes using electric hand drill</li><li>6. Bore holes using bench electric drilling machine</li><li>7. Cut thread using tap and die</li><li>8. Bore holes using portable electric hammer drill</li><li>9. Cut thread on steel conduits using stock and dies</li><li>10. Cut P.V.C. conduits, steel conduits and casings using hack-saw</li><li>11. Bend steel conduits using conduit bender</li><li>12. Mark Levels using levelling tube and spirit level</li><li>13. Cut walls using hammer, cold chisel or angle grinder</li><li>14. Cover damages on walls with mortar</li><li>15. Fix accessories for steel conduits</li><li>16. Assembling metal parts using pop-rivet gun</li></ol>	
<b>Typical related work situations to master :</b> <ul style="list-style-type: none"><li>• Handling Tools</li><li>• Prepare work pieces</li><li>• Prepare work places</li></ul>	
<b>Important pertinent Content (knowledge):</b>	<ul style="list-style-type: none"><li>• Materials used in electrical industry</li><li>• Hand tools and power tools</li><li>• Measuring tools and equipment<ul style="list-style-type: none"><li>➤ Steel ruler</li><li>➤ Measuring tape</li><li>➤ Vernier caliper</li><li>➤ Micrometer</li><li>➤ Sprit level</li><li>➤ Water tube</li><li>➤ Thread gauge</li><li>➤ Radius gauge</li></ul></li><li>• Files</li><li>• Chisels</li><li>• Hammers</li><li>• Vices</li></ul>

**Potentially useful teaching methods  
(optional):**

- Demonstrations
- Role plays
- Lectures
- Guided practice
- Video shows
- Assignments
- Projects

## Electrician–Level 4

<b>Module Title and Code:</b>	<b>Module 3: Principles of Electricity</b>
	<b>Time Frame: 120hrs</b>
<b>Reference to NCS:</b>	See Competency Profile
<p><b>Competencies (job functions and soft skills) and descriptions:</b></p> <p>At the end of this module student should be able to</p> <ol style="list-style-type: none"> <li>1. Measure electrical parameters using measuring instruments</li> </ol>	
<p><b>Typical related work situations to master :</b></p> <ul style="list-style-type: none"> <li>• Measure voltage , current and resistance using multi meter</li> <li>• Measure current in a load using clip on meter</li> <li>• Measure power in a load using watt meter</li> <li>• Measure energy in a load using kilo watt hour(KWh) meter</li> <li>• Measure insulation resistance using insulation resistance tester</li> <li>• Check phase sequence using phase sequence tester</li> </ul>	
<p><b>Important pertinent Content (knowledge):</b></p>	<ul style="list-style-type: none"> <li>• Electrical quantities <ul style="list-style-type: none"> <li>➤ Voltage</li> <li>➤ Current</li> <li>➤ Resistance</li> </ul> </li> <li>• Introduction of AC/DC power supply</li> <li>• Conductors &amp; Insulators</li> <li>• Ohm’s law</li> <li>• Kirchoff’s 1st and 2nd law</li> <li>• Electrical Measuring instruments</li> <li>• Simple electrical circuits</li> <li>• Power and energy</li> <li>• Magnetism &amp; Electro magnetism</li> <li>• Electro-magnetic induction and related laws</li> <li>• Inductance and inductors</li> <li>• Capacitance &amp; Capacitors</li> <li>• Types of electric lamps <ul style="list-style-type: none"> <li>➤ Incandescent</li> <li>➤ Gas discharge</li> <li>➤ LED</li> </ul> </li> <li>• Introduction to power generation ,transmission and distribution</li> <li>• Identify Low /Medium/ High voltage sources</li> <li>• Alternating current measurements <ul style="list-style-type: none"> <li>➤ Frequency</li> <li>➤ Average value</li> <li>➤ RMS value</li> <li>➤ Peak value</li> </ul> </li> <li>• Simple AC Circuits <ul style="list-style-type: none"> <li>✓ Inductive reactance</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>✓ Capacitive reactance</li> <li>✓ Impedance</li> <li>• Power in AC circuits and power factor</li> <li>• Principles of transformers</li> <li>• Types of transformers <ul style="list-style-type: none"> <li>➤ Step up and Step down transformers</li> <li>➤ Auto transformers(Tapped winding)</li> <li>➤ Isolation transformers</li> <li>➤ Potential transformers</li> <li>➤ Current transformers</li> </ul> </li> </ul>
<p><b>Potentially useful teaching methods (optional):</b></p>	<ul style="list-style-type: none"> <li>• Lectures</li> <li>• Demonstrations</li> <li>• Lab Practical</li> <li>• Assignments</li> </ul>



## Electrician–Level 4

<b>Module Title and Code:</b>	<b>Module 04: Draw wiring diagrams</b>
	<b>Time Frame: 60hrs</b>
<b>Reference to NCS:</b>	See Competency Profile
<b>Competencies (job functions and soft skills) and descriptions:</b>  At the end of this module student should be able to <ol style="list-style-type: none"><li>1. Interpret diagrams related to electrical installation work</li><li>2. Draw electrical diagrams for a given electrical installation according to requirement.</li></ol>	
<b>Typical related work situations to master :</b> <ul style="list-style-type: none"><li>• Draw diagrams for electrical installations</li><li>• Interpret diagrams related to electrical installation work</li></ul>	
<b>Important pertinent Content (knowledge):</b>	<ul style="list-style-type: none"><li>• Different symbols used in electrical wiring and layout diagrams</li><li>• Symbols used for electrical accessories, switch gears and equipment</li><li>• Types of diagrams related to electrical installations</li><li>• Regulations (IEE/IET regulations) applicable for electrical wiring diagrams</li></ul>
<b>Potentially useful teaching methods (optional):</b>	<ul style="list-style-type: none"><li>• Lectures</li><li>• Demonstrations</li><li>• Drawing Practices</li><li>• Assignments</li></ul>

## Electrician–Level 4

<b>Module Title and Code:</b>	<b>Module 05: Make L.T Electric cable joints and terminations</b> <b>Time Frame: 30hrs</b>
<b>Reference to NCS:</b>	See Competency Profile
<b>Competencies (job functions and soft skills) and descriptions:</b>  At the end of this module student should be able to <ol style="list-style-type: none"> <li>1. Make straight joints(Single and multi-stranded cables)</li> <li>2. Make lug terminations</li> <li>3. Make T-joints</li> <li>4. Make “T”-lug joints</li> <li>5. Make straight joints using a ferrule</li> <li>6. Solder wire joints</li> <li>7. Insulate joints using insulating materials</li> <li>8. Fix cables gland for armoured /unarmoured cables</li> <li>9. Make cables terminations for armoured /unarmoured cables</li> <li>10. Termination of armoured cables</li> </ol>	
<b>Typical related work situations to master :</b> <ul style="list-style-type: none"> <li>• Make different types of cable joints and terminations</li> </ul>	
<b>Important pertinent Content (knowledge):</b>	<ul style="list-style-type: none"> <li>• Identification of Low voltage cables             <ul style="list-style-type: none"> <li>➤ Size</li> <li>➤ Type (Single core/Multi core, Cu/Al ,armoured/unarmoured)</li> <li>➤ Insulation material(XLPE/PVC)</li> <li>➤ Cables for different applications</li> </ul> </li> <li>• Voltage drop</li> <li>• Current carrying capacity</li> <li>• Installation/Laying methods</li> </ul>
<b>Potentially useful teaching methods (optional):</b>	<ul style="list-style-type: none"> <li>• Lectures</li> <li>• Demonstrations</li> <li>• Workshop Practices</li> <li>• Site visits</li> </ul>

## Electrician–Level 4

<b>Module Title and Code:</b>	<b>Module 06: Carry out electrical Installation in buildings</b>
	<b>Time Frame: 250hrs</b>
<b>Reference to NCS:</b>	See Competency Profile
<b>Competencies (job functions and soft skills) and descriptions:</b>	
At the end of this module student should be able to	
<ol style="list-style-type: none"><li>1. Draw layout plans for electrical installations</li><li>2. Draw Wiring Diagrams for layout plans</li><li>3. Mark electrical points as per the layout diagram on the building</li><li>4. Fix PVC casing and capping</li><li>5. Lay PVC conduits</li><li>6. Install single pole one- way switch circuit</li><li>7. Install two-way switch circuits</li><li>8. Install intermediate switch circuits</li><li>9. Install socket outlet circuits</li><li>10. Install impulse relay circuits</li><li>11. Install staircase lighting timer switch circuits</li><li>12. Install ring socket outlet circuits</li><li>13. Install radial socket outlet circuits</li><li>14. Install calling bell circuits/ door phones</li><li>15. Assemble fluorescent lamp circuits</li><li>16. Fix wall mounted lamp</li><li>17. Fix pendent lamp</li><li>18. Fix chandelier lamps</li><li>19. Install exhaust fans</li><li>20. Install wall fans</li><li>21. Install ceiling fans</li><li>22. Install security lamp circuits</li><li>23. Install electric door opening circuits</li><li>24. Install dimmer switches</li><li>25. Install domestic water pumps circuits</li><li>26. Install automatic water level controls</li><li>27. Install shaver sockets</li><li>28. Install single/three phase distribution board/consumer unit</li><li>29. Install surge protection devices</li><li>30. Install earth electrodes</li><li>31. Identify/Locate faults in single/three phase electrical installation</li></ol>	
<b>Typical related work situations to master :</b>	
<ul style="list-style-type: none"><li>• Carry out a single phase electrical installation in buildings</li><li>• Carry out a three phase electrical installation in buildings</li></ul>	

<p><b>Important pertinent Content (knowledge):</b></p>	<ul style="list-style-type: none"> <li>➤ Regulations (IEE/IET regulations) applicable for electric installation</li> <li>➤ SL Government regulations applicable for electric installation (CIDA, PUC etc.)</li> <li>➤ Deciding of circuits as per the load</li> <li>➤ Selection of Over Current Protective Devices(OCPD) according to the loads</li> <li>➤ Selection of cables according to current rating of OCPD</li> <li>➤ Selection of cables according to Voltage drop</li> <li>➤ Operating principles and applications of <ul style="list-style-type: none"> <li>○ Miniature Circuit Breaker (MCB)</li> <li>○ Residual Current Circuit Breakers(RCCB)</li> <li>○ Moulded Case Circuit Breakers (MCCB)</li> </ul> </li> <li>➤ Selection of Residual Current Circuit Breakers(RCCB) according to current ratings and sensitivity</li> <li>➤ Spacing and sizes of wiring clips</li> <li>➤ Ring circuit/ radial circuits</li> <li>➤ Difference between Isolator and MCB</li> <li>➤ Timers</li> <li>➤ Impulse relays</li> <li>➤ Single, Two way, intermediate and push button switches</li> <li>➤ Rotary and MCB type changeover switches</li> <li>➤ Shaver sockets</li> <li>➤ Earth electrodes and earthing cables</li> <li>➤ Surge protectors</li> <li>➤ Door openers</li> <li>➤ Exhaust fan</li> <li>➤ Water geezers</li> <li>➤ Automatic water level control systems(Float and electronic types)</li> <li>➤ Types of electrical conduits, casing &amp; capping trunking etc. and their applications and cutting/jointing /fixing methods</li> <li>➤ Electrical tools &amp; measuring instruments used in domestic electrical installation work</li> <li>➤ Identify soil condition and selection of earth electrode</li> <li>➤ Methods of insulation resistance testing</li> <li>➤ Methods of testing earth electrode resistance</li> </ul>
<p><b>Potentially useful teaching methods (optional):</b></p>	<ul style="list-style-type: none"> <li>● Lectures</li> <li>● Demonstrations</li> <li>● Workshop Practices</li> <li>● Site visits</li> <li>● Assignments</li> <li>● Projects</li> </ul>

## Electrician–Level 4

<b>Module Title and Code:</b>	<b>Module 07: Carry out industrial electrical Installation</b>
	<b>Time Frame: 200hrs</b>
<b>Reference to NCS:</b>	See Competency Profile
<b>Competencies (job functions and soft skills) and descriptions:</b>	
At the end of this module student should be able to	
<ol style="list-style-type: none"><li>1. Draw /read and interpret industrial installation diagrams</li><li>2. Read and interprets conduits System layouts</li><li>3. Prepare steel conduits</li><li>4. Cut thread in steel conduits</li><li>5. Bend steel conduits</li><li>6. Arrange cable trays</li><li>7. Lay steel conduits</li><li>8. Cut holes using hole cutters on enclosures and trunking</li><li>9. Install cable metal trunking</li><li>10. Make Circuit Protective Conductor terminations on all metal parts</li><li>11. Install main panel board with Change-Over Switch(COS) / Automatic transfer switch</li><li>12. Make identification marks on bus- bars and distribution boards</li><li>13. Install single phase sub distribution boards</li><li>14. Install three phase sub distribution boards</li><li>15. Connect L.T. cables from main supply to main distribution board</li><li>16. Lay underground cables</li><li>17. Install earth electrodes</li><li>18. Install three / four pole Miniature Circuit Breakers (M.C.B.)</li><li>19. Install three / four pole Molded Case Circuit Breaker (M.C.C.B.)</li><li>20. Install three / four pole isolators</li><li>21. Check the phase sequence</li><li>22. Install single phase industrial socket outlets</li><li>23. Install three phase industrial socket outlets</li><li>24. Install outdoor lamp fittings</li><li>25. Install DOL starters for single phase motors</li><li>26. Install DOL starters for three phase motors</li><li>27. Install Star-Delta starters for three phase motors</li><li>28. Install kilowatt-hour Meter</li><li>29. Install power analyzer</li><li>30. Install capacitor banks for power factor improvements</li></ol>	

**Typical related work situations to master :**

- Installation of cable management system such as steel trunking, cable trays, cable ladders, steel conduit, PVC trunking and conduit
- Install power distribution systems (MDB, SDBs, COS/ATS), consumer unit and bus-bar trunking, bus-bar rising

**Important pertinent Content (knowledge):**

- Generation of 3 phase power supply
- Star – Delta connection methods
- Consumer supply- 3 phase 4 wire
- 3 phase 4 wire distribution systems
  - TT system
  - TNC system
  - TNCS system
  - TNS system
- TT system used in LT distribution in Sri Lanka
- Importance of neutral earthing in 3 phase power sources
- Active power, reactive power and apparent power
- Power factor improvement methods
- Contactors for capacitor switching
- Power factor controllers
- Capacitors for power factor improvements
- Calculation of total power in 3 phase balance and unbalance loads with given data
- Power measuring methods in 3 phase loads
- Current transformers and potential transformers
- Types of power analyzers and connecting methods
- Importance of polarity of current transformers
- Isolation and switching according to regulations
- Importance of load balancing
- Cable management systems
  - Conduits (Rigid and flexible) and accessories
  - Casing and capping
  - Cable trays
  - Trunking and Pull box
  - Cable ladders
  - Cable glands
- Cable laying methods- Armoured and unarmoured
- Bus-bar risers in high rise buildings
- Socketed and lighting bus-bar trunking system
- Principle, types and applications of manual change over switches and automatic transfer switches and Automatic Main Failure (AMF)

**Potentially useful teaching methods  
(optional):**

- Lectures
- Demonstrations
- Workshop Practices
- Site visits
- Assignments
- Projects

## Electrician–Level 4

<b>Module Title and Code:</b>	<b>Module 08: Assemble LV distribution board</b>  <b>Time Frame: 90hrs</b>
<b>Reference to NCS:</b>	See Competency Profile
<b>Competencies (job functions and soft skills) and descriptions:</b>  At the end of this module student should be able to <ol style="list-style-type: none"> <li>1. Draw and interpret control circuit wiring diagrams</li> <li>2. Fix bus-bars in metal enclosures</li> <li>3. Fix MCBs ,MCCB, Isolators, RCCB , and HRC fuses in enclosures</li> <li>4. Install under/over voltage trip relays and shunt trip relays in MCCBs in panel boards</li> <li>5. Install ELR, EFR and PFR units on enclosures in panel boards</li> <li>6. Install current transformers and core balance transformers in enclosures</li> <li>7. Install analog and digital measuring instruments , selector switches and indicator lamps</li> <li>8. Install Surge Protective Devices(SPD)</li> <li>9. Carry out control wiring, power cabling and distribution boards</li> <li>10. Test function of protective relays and protective devices</li> </ol>	
<b>Typical related work situations to master :</b> <ul style="list-style-type: none"> <li>• Draw lay out diagrams of power distribution boards</li> <li>• Draw control wiring diagram for ELR, EFR, PFR, and instrumentation</li> <li>• Lay out component of distribution boards</li> <li>• Assemble LV distribution board</li> </ul>	
<b>Important pertinent Content (knowledge):</b>	<ul style="list-style-type: none"> <li>• Operating principles and applications of             <ul style="list-style-type: none"> <li>➤ Isolators</li> <li>➤ Miniature Circuit Breaker (MCB)</li> <li>➤ Moulded Case Circuit Breakers (MCCB)</li> <li>➤ Residual Current Circuit Breakers(RCCB)/ Residual Current Devices(RCD)</li> <li>➤ High Rupturing Capacity(HRC/HBC) fuse categories and fuse carriers</li> <li>➤ Air Circuit Breakers</li> <li>➤ Oil Circuit Breakers</li> </ul> </li> <li>• Applications of             <ul style="list-style-type: none"> <li>➤ Earth Leakage Relay (ELR) and Core Balance Transformer(CBT)</li> <li>➤ Earth Fault Relay (EFR)</li> <li>➤ Phase Failure Relay (PFR)</li> <li>➤ Shunt Trip Relay (STR) /Under Voltage Trip Relay(UVT)</li> </ul> </li> <li>• Panel meters (Analogue and digital) and indicator lamps</li> <li>• Voltmeter and ammeter selector switches</li> <li>• Accessories for panel wiring (Cooling fans, Cable lugs, cable markers, cable tie and holders, cable tag, slotted trunking, earth continuity jumpers,colour end caps, legend plates, DIN railing, bus-bar chambers, comb bus bars, and supporters</li> </ul>



	<p>etc.)</p> <ul style="list-style-type: none"><li>• Control circuit wiring diagrams</li><li>• Types of enclosures and index of protection</li></ul>
<b>Potentially useful teaching methods (optional):</b>	<ul style="list-style-type: none"><li>• Lectures</li><li>• Demonstrations</li><li>• Workshop Practices</li><li>• Site visits</li><li>• Assignments</li><li>• Projects</li></ul>

## Electrician–Level 4

<b>Module Title and Code:</b>	<b>Module 09: Install, Repair and Maintain Electrical Control Circuits &amp; Equipment</b>
	<b>Time Frame: 200hrs</b>
<b>Reference to NCS:</b>	See Competency Profile
<b>Competencies (job functions and soft skills) and descriptions:</b>	
<p>At the end of this module student should be able to</p> <ol style="list-style-type: none"><li>1. Install/Replace cam switches</li><li>2. Install/Replace limit switches</li><li>3. Install/Replace emergency switches</li><li>4. Install/Replace printed circuit board and electronic units</li><li>5. Install/Replace counter meters</li><li>6. Install/Replace timer switches</li><li>7. Install/Replace push button switches</li><li>8. Install/Replace temperature controllers and set parameters</li><li>9. Install/Replace ampere meters and voltmeters</li><li>10. Install/Replace RPM meters</li><li>11. Install/Replace contactor coils</li><li>12. Install/ Replace relays contactors&amp; thermal overload relays</li><li>13. Install/Replace slip ring motor starters</li><li>14. Install/Replace earth fault/leakage relay</li><li>15. Install/Replace pressure switch</li><li>16. Install/Replace thermal switch</li><li>17. Install/Replace variable resistors</li><li>18. Install/Replace RTD sensors</li><li>19. Install/Replace photo electric sensors and switches</li><li>20. Install/Replace proximity sensors</li><li>21. Install/Repair auto- transformer starter</li><li>22. Install/Replace float switch</li><li>23. Install/Replace solenoid valves</li><li>24. Install/Replace thermo couples</li><li>25. Check cable termination</li><li>26. Install/Replace current transformer</li><li>27. Install/Replace control transformers</li><li>28. Install/Replace indicator lamp</li><li>29. Install/Replace D.C Motor drives, VFD and soft starters and set parameters</li><li>30. Install/Replace current transformer</li><li>31. Install/Replace power analyzer , Kwh meters and set parameters</li><li>32. Install/Replace Frequency meter</li><li>33. Service electrical panel boards</li></ol>	

**Typical related work situations to master :**

- Assemble DOL circuit
- Assemble forward-reverse circuit
- Assemble automatic Star-Delta circuit
- Assemble automatic Star-Delta forward-reverse circuit
- Assemble on delay and off delay timer circuits
- Assemble temperature/ proximity/ photo electric control systems
- Install motor drives
- Faults finding in control circuits (Simulated faults)

**Important pertinent Content (knowledge):**

- Motor starting methods
- Principles and application of motor control switch gears and control components
- Isolation/control transformers
- Types and applications of sensors
- Types and applications of time delay relays
- Principle and applications DC motor drives
- Principle and applications Variable Frequency Drives
- Principle and applications Soft Starters
- Principle and Selection of insulation resistance tester (Megger)
- Principle and application of Solid State Relays(SSR)

**Potentially useful teaching methods (optional):**

- Lectures
- Demonstrations
- Workshop Practices
- Site visits
- Assignments
- Projects

## Electrician–Level 4

<b>Module Title and Code:</b>	<b>Module 10: Repair &amp; Maintain Electrical Equipment</b>
	<b>Time Frame: 48hrs</b>
<b>Reference to NCS:</b>	See Competency Profile
<b>Competencies (job functions and soft skills) and descriptions:</b> At the end of this module student should be able to <ol style="list-style-type: none"><li>1. Service ceiling fans</li><li>2. Service exhaust blower fans</li><li>3. Repair fluorescent lamp fittings</li><li>4. Replace LED drives and chips in LED lamps</li><li>5. Service electrical circuit in portable hand power tools</li><li>6. Service electrical circuit of heavy power tools</li><li>7. Repair electrical circuit of water pumps</li><li>8. Repair discharge lamp fittings</li><li>9. Repair water geysers</li></ol>	
<b>Typical related work situations to master :</b> <ul style="list-style-type: none"><li>• Service electrical equipment</li></ul>	
<b>Important pertinent Content (knowledge):</b>	<ul style="list-style-type: none"><li>• Type of single phase motors used in electrical appliances and their construction<ul style="list-style-type: none"><li>➤ Universal motors</li><li>➤ Shaded pole</li><li>➤ Split phase</li><li>➤ Capacitor start and run</li><li>➤ Capacitor start induction run</li><li>➤ Capacitor start capacitor run</li></ul></li><li>• Speed control methods as applicable</li><li>• Specifications of LED lamps, advantages and limitations compared with other types of lamps</li><li>• Principle of water geysers, safety features and applicable standards</li></ul>
<b>Potentially useful teaching methods (optional):</b>	<ul style="list-style-type: none"><li>• Lectures</li><li>• Demonstrations</li><li>• Workshop Practices</li><li>• Assignments</li></ul>

## Electrician–Level 4

<b>Module Title and Code:</b>	<b>Module 11: Repair and Maintain Electric Motors</b>
<b>Reference to NCS:</b>	See Competency Profile
<b>Competencies (job functions and soft skills) and descriptions:</b>  At the end of this module student should be able to  <ol style="list-style-type: none"><li>1. Check terminations</li><li>2. Dismantle motor for service / repair</li><li>3. Clean motor using cleaning agents</li><li>4. Remove moisture in motor using heating lamp</li><li>5. Remove moisture in motor using electric oven</li><li>6. Remove moisture in motor using hot air</li><li>7. Replace tacho generator brushes</li><li>8. Undercut commutator</li><li>9. Test armatures on growler</li><li>10. Conduct insulation resistance test</li><li>11. Replace brushes in motor</li><li>12. Adjust brush rocker (adjust brush angle)</li><li>13. Lubricate motor bearings</li><li>14. Improve the insulation resistance</li><li>15. Align and install motor</li><li>16. Replace cooling fan</li><li>17. Replace pulley and pulley key</li><li>18. Replace oil seal</li><li>19. Replace armature</li><li>20. Replace bearings</li><li>21. Replace capacitors in single phase motors</li><li>22. Replace magnetic clutch / brake</li><li>23. Replace centrifugal switch / starting relays</li><li>24. Check no load and load current and RPM</li></ol>	
<b>Typical related work situations to master :</b>  <ul style="list-style-type: none"><li>• Repair single and three phase water pumps</li><li>• Repair portable electric power tools</li><li>• Repair 3phase induction motor (at least a 7.5Kw)</li></ul>	
<b>Important pertinent Content (knowledge):</b>	<ul style="list-style-type: none"><li>• Types of 3 phase motors<ul style="list-style-type: none"><li>➤ Squirrel cage motors</li><li>➤ Wound rotor motors</li><li>➤ Synchronous motors</li><li>➤ Permanent magnet synchronous motors</li></ul></li><li>• Type of DC motors<ul style="list-style-type: none"><li>➤ Series motors</li><li>➤ Shunt motors</li><li>➤ Compound motors</li></ul></li></ul>

	<ul style="list-style-type: none"> <li>• Introduction to Special motors <ul style="list-style-type: none"> <li>➤ Servo motors</li> <li>➤ Brushless motors</li> <li>➤ Stepper motors</li> <li>➤ Eddy current clutch type motors</li> </ul> </li> <li>• Identification of name plate details</li> <li>• Cleaning methods and cleaning agents</li> <li>• Types of insulating materials</li> <li>• Insulation resistance improving methods</li> <li>• Types of bearings used in electric motors</li> <li>• Types of oil seals</li> <li>• Types of pulleys and belts</li> <li>• Types of couplings</li> <li>• Types of water seals used in water pumps</li> <li>• Types of carbon brushes</li> <li>• Armature construction</li> <li>• Types of capacitors, their rating and testing methods</li> <li>• Types of starting relays</li> <li>• Types of magnetic clutches and brakes</li> <li>• Types of lubricants</li> </ul>
<p><b>Potentially useful teaching methods (optional):</b></p>	<ul style="list-style-type: none"> <li>• Lectures</li> <li>• Demonstrations</li> <li>• Workshop Practices</li> <li>• Site visits</li> <li>• Assignments</li> <li>• Projects</li> </ul>

## Electrician–Level 4

<b>Module Title and Code:</b>	<b>Module 12: Maintain Standby Generators</b> <b>Time Frame: 30hrs</b>
<b>Reference to NCS:</b>	See Competency Profile
<b>Competencies (job functions and soft skills) and descriptions:</b> At the end of this module student should be able to <ol style="list-style-type: none"><li>1. Change generator engine oil and replace oil filter</li><li>2. Replace water separation filter</li><li>3. Prepare generator for running</li><li>4. Replace air filter</li><li>5. Maintain battery bank</li><li>6. Conduct alternator insulation resistance test</li><li>7. Maintain change-over switch</li><li>8. Maintain automatic transfer switch</li><li>9. Replace Automatic Voltage Regulator(AVR)</li></ol>	
<b>Typical related work situations to master :</b> <ul style="list-style-type: none"><li>• Maintain battery</li><li>• Service and maintain generator</li></ul>	
<b>Important pertinent Content (knowledge):</b>	<ul style="list-style-type: none"><li>• Types of alternators and their principles and construction</li><li>• Specification of alternators</li><li>• Types of air filters and oil filters</li><li>• Identification of name plate details</li><li>• Need of Automatic Voltage Regulator(AVR) and their types</li><li>• Specification of AVR types</li><li>• Alternator heaters</li><li>• Recommended bench test for AVR function</li><li>• Insulation resistance test for alternator</li><li>• External excitation test for alternator</li><li>• Principle of lead-acid cell and recharging</li><li>• Maintenance of batteries and testing methods</li><li>• Basic principles of diesel and petrol engines</li><li>• Importance of engine speed governors (Mechanical/ Electronic types)</li><li>• Importance of lubricating and cooling of engine</li><li>• Types of lubricants</li><li>• Automatic battery charges for standby generators</li><li>• Interpret maintenance charts and manuals</li><li>• Methods of maintaining records</li></ul>

**Potentially useful teaching methods  
(optional):**

- Lectures
- Demonstrations
- Workshop Practices
- Site visits
- Assignments
- Projects



## Electrician–Level 4

<b>Module Title and Code:</b>	<b>Module 13: Carry out commissioning and maintaining of electrical installations</b>  <b>Time Frame: 30hrs</b>
<b>Reference to NCS:</b>	See Competency Profile
<b>Competencies (job functions and soft skills) and descriptions:</b>  At the end of this module student should be able to <ol style="list-style-type: none"> <li>1. Carry out Visual Inspection</li> <li>2. Carry out Continuity and Polarity Testing</li> <li>3. Carry out Insulation resistance testing</li> <li>4. Carry out Phase Sequence Test</li> <li>5. Carry out Earth electrode Resistance Test</li> <li>6. Carry out Testing of RCD/ RCCB/ELR/EFR with standard tester</li> <li>7. Diagnose faults in electrical panel boards in buildings and factories</li> <li>8. Replace defective components in electrical panel boards in buildings and factories</li> <li>9. Repair faults in electrical installations in buildings and factories</li> <li>10. As build drawings developed according to the actual installation</li> <li>11. Check and record parameters of electrical loads</li> </ol>	
<b>Typical related work situations to master :</b> <ul style="list-style-type: none"> <li>• Carry out inspection and testing in electrical installation before and after commissioning</li> <li>• Diagnose faults in electrical panel boards in buildings and factories</li> <li>• Repair faults in electrical installations in buildings and factories</li> </ul>	
<b>Important pertinent Content (knowledge):</b>	<ul style="list-style-type: none"> <li>• Trouble shooting procedures, techniques and instruments</li> <li>• Record keeping procedures related to electrical loads</li> <li>• Effects of loose terminations in electrical panel boards</li> <li>• Lightning surge effects</li> <li>• Effects due to moisture and polluted environmental conditions such as gases, chemicals, sea breeze etc..</li> <li>• Tests applicable to electrical installations according to IEE /IET regulation             <ul style="list-style-type: none"> <li>➤ Polarity</li> <li>➤ Continuity of ring circuits and circuit protective conductors</li> <li>➤ Insulation resistance tests</li> <li>➤ Resistance of earth electrodes</li> </ul> </li> <li>• IEE/IET regulations related to insulation resistance testing</li> <li>• Selection of insulation resistance tester (Megger)</li> <li>• Testing methods of earth electrode resistance</li> <li>• Methods of improving earth electrode resistance</li> </ul>

**Potentially useful teaching methods  
(optional):**

- Lectures
- Demonstrations
- Workshop Practices

## Electrician–Level 4

<b>Module Title and Code:</b>	<b>Module 14: Prepare cost estimate</b>
	<b>Time Frame: 24hrs</b>
<b>Reference to NCS:</b>	See Competency Profile
<b>Competencies (job functions and soft skills) and descriptions:</b>  At the end of this module student should be able to  <ol style="list-style-type: none"><li>1. Communicate with clients</li><li>2. Prepare layout diagram for wiring</li><li>3. Prepare layout diagram for conduit laying</li><li>4. Prepare material list with specifications</li><li>5. Prepare accessories list with specifications</li><li>6. Calculate labour cost</li><li>7. Calculate the material cost</li><li>8. Calculate overheads and profits</li><li>9. Calculate contingencies</li></ol>	
<b>Typical related work situations to master :</b>  <ul style="list-style-type: none"><li>• Prepare cost estimate for electrical installation of a building</li><li>• Prepare cost estimate for industrial electrical installation</li></ul>	
<b>Important pertinent Content (knowledge):</b>	<ul style="list-style-type: none"><li>• Quality and standards of materials</li><li>• Market prices of materials and accessories</li><li>• Taxes and government dues</li><li>• Profit and overhead</li><li>• Contingencies</li><li>• Supply authority policies on electricity supply to consumers</li><li>• IET regulations, Supply authority requirements, SLSI, CIDA requirements, Public Utilities Commission of Sri Lanka (PUCSL) rules and regulations</li></ul>
<b>Potentially useful teaching methods (optional):</b>	<ul style="list-style-type: none"><li>• Role plays</li><li>• Assignments</li><li>• Projects</li></ul>

## Electrician–Level 4

<b>Module Title and Code:</b>	<b>Module 15: Install and Maintain Programmable Logic Controllers</b>
<b>Reference to NCS:</b>	See Competency Profile
<b>Competencies (job functions and soft skills) and descriptions:</b>  At the end of this module student should be able to <ol style="list-style-type: none"><li>1. Install Programmable Logic Controller (PLC)</li><li>2. Write a Programme for a given control system</li><li>3. Install input and output devices</li><li>4. Connect input and output devices</li><li>5. Perform wiring of power circuit</li><li>6. Check power supply and input / output terminations</li><li>7. Up load software programme as necessary</li><li>8. Check performance of PLC based control system</li><li>9. Troubleshoot faults in PLC based control system</li><li>10. Replace memory backup battery</li><li>11. Replace memory card</li></ol>	
<b>Typical related work situations to master :</b>  Write, install and test the function of PLC programmes for control circuits of <ul style="list-style-type: none"><li>• DOL circuit</li><li>• Forward-reverse circuit</li><li>• Automatic Star-Delta circuit</li><li>• Automatic Star-Delta forward-reverse circuit</li><li>• Sequential circuits consisting timers and counters</li><li>• Automatic Transfer Switching(ATS) control circuit</li><li>• Faults finding in control circuits (Simulated faults)</li></ul>	
<b>Important pertinent Content (knowledge):</b>	<ul style="list-style-type: none"><li>• Basic logic gates and functions</li><li>• Introduction to PLC</li><li>• Advantages of PLCs in control circuits</li><li>• Basicfunctional block diagram of PLC</li><li>• Types of PLC including smart relays</li><li>• Human Machine Interface</li><li>• Input output interfacing techniques</li><li>• Power supplies for PLC</li><li>• Programming devices<ul style="list-style-type: none"><li>➤ Personal computer</li><li>➤ Consoles</li></ul></li><li>• PLC Programming languages(at least two including ladder)<ul style="list-style-type: none"><li>➤ Ladder</li><li>➤ Function Block</li><li>➤ Structured Text</li><li>➤ Sequential Function Charts</li></ul></li></ul>

	<ul style="list-style-type: none"> <li>➤ Instructional List</li> <li>• PLC Programming and instructions</li> <li>• Types of sensors <ul style="list-style-type: none"> <li>➤ Photo electric</li> <li>➤ Inductive</li> <li>➤ Capacitive</li> <li>➤ Ultrasonic</li> <li>➤ Thermal</li> <li>➤ Reed switch</li> </ul> </li> <li>• Types of encoders</li> <li>• Types of actuators (Hydraulic and pneumatic)</li> <li>• Types of solenoids</li> <li>• Types of Air motors</li> <li>• Types of motorized flow control valves</li> </ul>
<p><b>Potentially useful teaching methods (optional):</b></p>	<ul style="list-style-type: none"> <li>• Lectures</li> <li>• Demonstrations</li> <li>• Workshop Practices</li> <li>• Site visits</li> <li>• Assignments</li> <li>• Projects</li> </ul>

Module Title	Course Duration
<b>Building Career Skills 1</b>	At least 60 hours in 3 month course
<p><b>Objectives of this module</b></p> <p>All recent studies make it clear that one of the greatest problems noted with regard to the employability of students in the TVET sector is the absence of soft skills, in particular communicative competence in English. Employers have indicated that they would appreciate better English in their staff and the ability to communicate with more confidence.</p>	
<p><b>Competencies to be covered</b></p> <p><b>1. Understand and use simple expressions to communication</b>  This subject provides the necessary communication skills so that students can introduce themselves and interact with others, and can respond to simple questions and follow simple instructions, describe people, places, and tools.</p> <p><b>2. Read and write effectively</b>  This subject provides the necessary skills to find and understand the information given in a text, to understand notices, instructions and information, to take down short messages and write simple descriptions.</p> <p><b>3. Use English correctly</b>  This subject is not taught separately but is included in the development of the productive and receptive skills above, since awareness of the structure of the language is necessary for these The development of appropriate vocabulary is also targeted to deploy the above skills</p> <p><b>4. Develop the capacity to think and plan productively</b>  This subject develops cognitive abilities and skills with regard to effective work, with strengthening of thinking skills, recognition of systems, making deductions etc</p> <p><b>5. Develop effective working capacity</b>  This subject develops the capacity to work effectively individually and in collaboration with others through building the sense of individual responsibility, and accountability within a working group</p>	