

## APPLY ELECTRICAL PRINCIPLES II

**UNIT CODE:**0713441 13A

**TVET CDACC UNIT CODE: ENG/OS/MDE/CC/08/5/MA**

### UNIT DESCRIPTION

This unit describes competences required to apply electrical principles. Competences include applying magnetism and electromagnetism, applying electrostatics principles, applying ac circuits and conducting system earthing and protection.

### ELEMENTS AND PERFORMANCE CRITERIA

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
These describe the key outcomes which make up workplace function.	These are assessable statements which specify the required level of performance for each of the elements. <i>(Bold and italicized terms are elaborated in the Range)</i>
1. Apply magnetism and electromagnetism	1.1 Magnetic and non-magnetic materials are identified as per requirement. 1.2 Concepts of magnetic fields and field distribution are described as per electromagnetic laws 1.3 Existence of magnetic field is verified based on magnetic field strength. 1.4 <b>Laws of electromagnetic induction</b> are identified based on magnetic fields. 1.5 Concepts of electromagnetism are applied based on magnetic properties. 1.6 Concepts of self and mutual induction are applied as per electromagnetic laws.
2. Apply Electrostatics principles	2.1 Electrostatics quantities are identified as per type of charges. 2.2 Types of capacitors are identified as per application requirement.

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	<p>2.3 Calculations involving capacitors in series and parallel are performed as per electrostatic quantities.</p> <p>2.4 Capacitors are applied in electrical circuits as per application requirement.</p> <p>2.5 Capacitors are tested as per IEC standards.</p>
3. Apply AC circuits	<p>3.1 AC fundamentals are applied as per working principles.</p> <p>3.2 Equation of the sine wave is derived as per AC working principles.</p> <p>3.3 Calculation involving passive elements in AC circuits is performed based on the circuit requirement.</p> <p>3.4 Concept of Power triangle is applied as per AC working principles.</p> <p>3.5 Calculations involving power factor correction is performed as per working principles.</p> <p>3.6 Methods of power factor correction are applied as per working principles. .</p>
4. Conduct Electrical installation, System Earthing and protection	<p>4.1 <b>Electrical installation</b> is performed as per the applicable IEC and IET standards.</p> <p>4.2 System and equipment <b>protection principles</b> are applied as per the IEC and IET standards.</p> <p>4.3 <b>Protection system design</b> is performed as per the IEC standard.</p> <p>4.4 <b>Earthing system</b> is designed as per the IEC standards.</p> <p>4.5 <b>Test on an earthing system</b> is performed as per the applicable IEC and IET standards.</p> <p>4.6 Types of lightning strikes are identified based on Benjamin Franklin recommendations.</p>

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	<p>4.7 <b><i>Lightning system design</i></b> is performed as per the applicable IEC and IET standards.</p>

## RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
1. <b><i>Laws of electromagnetic induction</i></b> may include but not limited to:	<ul style="list-style-type: none"> <li>• Screw rule</li> <li>• Grip</li> <li>• Flemings</li> <li>• Faradays</li> </ul>
2. <b><i>Electrical installation</i></b> may include but not limited to:	<ul style="list-style-type: none"> <li>• Call and alarm circuits</li> <li>• Domestic wiring circuits</li> </ul>
3. <b><i>Protection principles</i></b> may include but not limited to:	<ul style="list-style-type: none"> <li>• Protection zones</li> <li>• Protection systems</li> </ul>
4. <b><i>Protection system design</i></b> may include but not limited to:	<ul style="list-style-type: none"> <li>• Protection system Drawings</li> <li>• Protection system Device sizing</li> <li>• Protection system Location</li> </ul>
5. <b><i>Earthing system is designed</i></b> may include but not limited to:	<ul style="list-style-type: none"> <li>• TT</li> <li>• TNC</li> <li>• TNCS</li> <li>• IT</li> <li>• TNS</li> </ul>
6. <b><i>Test on an earthing system</i></b> may include but not limited to:	<ul style="list-style-type: none"> <li>• Earth resistance test</li> <li>• Earth loop impedance test</li> </ul>

Variable	Range
7. <b><i>Lightning system design</i></b> may include but not limited to:	<ul style="list-style-type: none"> <li>• Lightning arrestors</li> <li>• Lightning design drawing</li> <li>• Size of lightning system</li> </ul>

## REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

### Required Skills

The individual needs to demonstrate the following skills:

- Apply basic Electrical formulas
- Use of basic Electrical instruments
- Perform various unit conversions of Electrical quantities
- Power factor correction
- logical thinking
- problem solving
- applying statistics
- drawing graphs
- Using different measuring tools

### Required knowledge

The individual needs to demonstrate knowledge of:

- Electrical power calculations
- Various laws in Electrical engineering
- Electrical formulas
- Power triangle
- SI units of various electrical parameters
- Selecting the correct type of electrical machines for various uses
- Types and purpose of measuring instruments
- Units of measurement and abbreviations

## EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

2 Critical aspects of Competency	Assessment requires evidence that the candidate: <ul style="list-style-type: none"><li>• Applied concepts of magnetism and electromagnetism.</li><li>• Applied concepts of A.C circuits.</li><li>• Applied concepts of electrostatics.</li><li>• Conducted System Earthing and protection</li><li>• Applied Two Port networks</li><li>• Applied Electromagnetic field Theory</li></ul>
6. Resource Implications	The following resources should be provided: 2.4 Access to relevant workplace or appropriately simulated environment where assessment can take place 2.5 Measuring equipment 2.6 Materials relevant to the proposed activity or tasks
7. Methods of Assessment	Competency may be assessed through: 3.7 Practical 3.8 Project 3.9 Third party report 3.10 Portfolio of evidence 3.11 Written tests 3.12 Oral questioning
8. Context of Assessment	Competency may be assessed in a workplace or a simulated workplace.
9. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.