

**1. Module details****Module name****Electrical Concepts****Module duration**

It is expected that students with the appropriate entry knowledge and skills will successfully complete this module in 36 – 40 hours.

**Module code**

NUE005

**Discipline code**

0703120

**2. Module purpose**

To provide an understanding of basic electrical principles and concepts including the effects of current flow in various circumstances and the various sources of emf. At the conclusion of this module students will be able to describe voltage, current, resistance, in both simple resistive loads and simple voltage sources in series, parallel and series - parallel circuits and to connect and make measurements in circuits of that kind.

[Note: This module has been derived from NE160 - Electrical Principles 1]

**3. Prerequisites**

Nil.

**4. Relationship to competency standards**

This module provides some of the knowledge and skills underpinning competence in the following standards:  
 Federal Metals Industry Award Standards, Unit 12.2A.  
 Electrical Contracting Industry Award Standards:  
 Electrical Stream - 5.1, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.10  
 Electronic Stream - 5.1, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8  
 Instrumentation Stream - 5.1, 5.2, 5.3, 5.4, 5.6, 5.7, 5.8.

**5. Content****Basic electrical concepts**

SI units

electrical quantities (charge, current, voltage, resistance)

factors affecting resistance

work, energy, power (mechanical, electrical)

conventional current flow, electron flow

**Effects of current**

physiological

chemical (electroplating, corrosion)

magnetic

thermal (ohmic, peltier)

**Sources of emf**

photovoltaic

thermal

electromagnetic  
chemical

**Simple practical circuit**

voltage source with fuse or circuit breaker (briefly explained)  
and single resistor  
principle of operation  
terms (short – circuit, open – circuit, overload)

**Series, parallel and series - parallel DC circuits, including the connection of meters in either series or parallel**

series circuit connection  
resistance in series  
parallel circuit connection  
resistance in parallel  
series - parallel circuit connections

**Batteries and battery connections**

characteristics of primary and secondary cells  
handling and charging secondary cells  
terminal voltage

**Measurement using meters**

multimeters  
ideal and practical meter characteristics  
loading effect  
sources of error in meter reading

**6. Assessment strategy**

**Assessment methods**

Assessment need not take place at the end of every learning outcome, that is, providers of training are encouraged to assess learning outcomes using an integrated approach where appropriate. Learning outcomes may be grouped together and assessment of the module may be achieved through an overall project or activity which takes account of all learning outcomes.

The following methods are suggested for measuring progress towards and achievement of the learning outcomes of this module:

- verbal or written report
- practical demonstration
- oral questioning etc

To be credited with this module the trainee must demonstrate competency in all learning outcomes.

On Job assessment tasks are described in the On Job Training Record Book.



<b>Conditions of assessment</b>	<p>The conditions related to assessment of the learning outcomes are dependent on the mode of delivery. A range of assessment strategies or options are available to suit the needs of the trainees. The needs of the trainee will be met by the provision of:</p> <ul style="list-style-type: none"> <li>- a real or simulated electrical wholesale environment appropriate to the assessment task</li> <li>- relevant trainee handouts, guidelines and reference material</li> <li>- appropriate equipment and facilities</li> </ul>
<b>7. Learning outcome details</b>	
<b>Learning outcome 1</b>	<b>Demonstrate a knowledge of basic electrical concepts.</b>
<b>Assessment criteria</b>	<p>1.1 Explain the basic and derived quantities and state their unit of measurement.</p> <p>1.2 State the difference between conventional and electron current flow.</p> <p>1.3 Compare the electrical characteristics of common types of conductors, insulators and semi - conductors and state typical applications.</p>
<b>Learning outcome 2</b>	<b>Demonstrate a knowledge of the various effects of current.</b>
<b>Assessment criteria</b>	<p>2.1 State various beneficial and non - beneficial examples of the chemical effect of current flow.</p> <p>2.2 Demonstrate an awareness of the physiological effect of current and its danger to health and safety.</p> <p>2.3 Explain various beneficial and non - beneficial aspects of the magnetic effect of current.</p> <p>2.4 Explain the thermal effect of current flow and give beneficial and non - beneficial examples of that effect.</p>
<b>Learning outcome 3</b>	<b>Demonstrate a knowledge of the various sources of electromotive force.</b>
<b>Assessment criteria</b>	<p>3.1 State the principle of the photovoltaic effect and provide examples of its use.</p> <p>3.2 State the principle of the thermoelectric effect and give examples of it.</p> <p>3.3 State the principle of electromagnetically induced voltage.</p>

**Learning outcome 4**

**Explain the operation of a simple practice circuit.**

**Assessment criteria**

- 4.1 Explain the terms ‘circuit’, ‘load’, ‘source’, ‘short - circuit’, ‘open - circuit’ and ‘overload’.
- 4.2 Demonstrate an understanding that current flows only in a closed circuit.
- 4.3 Describe the series, parallel and series / parallel circuit connections.
- 4.4 Explain the purpose of a switch and a protection device in a circuit.
- 4.5 Explain the operation of protective devices, such as rewirable fuse, cartridge fuse, thermal circuit breaker and magnetic circuit breaker.

**Learning outcome 5**

**Describe and select a suitable cell / battery for a specific application.**

**Assessment criteria**

- 5.1 Describe the difference between primary cells with secondary cells in terms of:
  - size
  - voltage
  - capacity
  - cost.
- 5.2 State procedures and precautions for handling and charging secondary cells / batteries.
- 5.3 Select a suitable cell / battery for common applications.

**Learning outcome 6**

**Measure voltage, current and resistance in any part of a DC circuit using digital and analog meters.**

**Assessment criteria**

- 6.1 Compare the operational characteristics of digital and analog multimeters against those of ideal meters.
- 6.2 Explain the “loading effect” of meters.
- 6.3 Identify sources of error in the reading indicated by both analog and digital multimeters.

**8. Delivery of the module**

**Delivery strategy**

Delivery strategies must be suitable for both theoretical and / or practical learning and module purpose. It is recommended that learning and assessment be facilitated in a holistic manner which may require a learning outcome sequence other than that indicated in the body of this module. Also an integrated theory / practice approach should be used where students learn by experimentation and through research and laboratory reports.

**Resource requirements**

**Specialised facilities and equipment**

The training provider should have access to:

- range of experimental circuit devices
- measuring equipment.

**Training staff and assessors**

Integrated theory and practical lessons.

**Learning resources**

The references listed below should not be regarded as a definitive list and should be amended and updated on a regular basis. This list is not intended to be prescriptive as it is realised that many teachers / trainers have assembled their own references and resources.

Edwards, R.C.L., Meyer D.F. *Electrical and Electronic Trades Principles and Applications*, McGraw - Hill, Sydney, 1995.

Jenneson, J.R. *Electrical Principles for the Electrical Trades*, McGraw - Hill, Sydney, 1995.

Phillips, P. *Electrical Fundamentals*, Nelson, Melbourne, 1994.

**Occupational health and safety requirements**

A safe and healthy environment will be provided for students in regards to classroom and laboratory safety.