

1. Module details**Module name****Applied Electrical Science****Module duration**It is expected that learners with the appropriate entry skills will successfully complete this module in **40 hours**.**Module code**

NUE 078

Discipline code**2. Module purpose**

This module provides basic knowledge of electrical principles and basic components. Learners will gain knowledge in the principles of electrical conduction, the electrical characteristics of material and the conversion of electric current to other forms. Physiological and damaging effects of current and how these are dealt with in practice is also covered. In addition, learners will gain an understanding of the relationship between voltage and current and develop skills in working safely with circuits and using and caring for electrical measuring instruments.

3. Prerequisites

Mathematical skills equivalent to module NUE 077
Electrotechnology Calculations

4. Relationship to competency standards

This module provides part of the underpinning knowledge and skills identified in the 'Evidence Guide' of specific units in the National Electrotechnology Competency Standards. The module provides similar support for equivalent units in the National Metals and Engineering Competency Standards.

5. Content**1. Components**

resistors

fixed (composition & wire wound)

variable (rheostats, potentiometers & trimmers)

non-linear (thermistors, VDRs, LDRs)

capacitors

fixed (ceramic, plastic & electrolytic)

variable, trimmers

magnetic

transformers (AF, RF and power)

chokes

relays

contactors

2. Basic physics

conductors

definition

common types

typical applications

insulators

definition
common types
typical applications
semiconductors
definition
common types
typical applications
current flow
direction (electron/conventional)
unit
effects of current flow
voltage
sources (electromagnetic, chemical, heat & pressure)
unit
resistance
factors effecting (material, length, csa & temp)
effect on circuit
colour code
preferred values (mention only)
power rating
Ohms law
electrical Units (include sub and multiple)
volt, ampere, Ohm & Watt
power in electrical circuits
 $P = IV$ only
introductory circuit symbols

3. Effects of electric current

heating
light
magnetic
chemical
physiological

4. Circuits

series and parallel (three resistive elements max.)
V,I,R & P relationships
use lab experiments to validate theory

5. Protection

purpose
fuses
circuit breaking
safety interlocks
earthing – personnel safety

6. Assessment strategy**Assessment methods**

Assessment should be progressive reflecting an holistic approach to ensure the module purpose is met. To assist in ensuring validity, reliability and fairness assessment instruments should include practical exercises, assignments, and written tests consisting of a number of item types, such as multiple choice, short answer, and problem solving.

Conditions of assessment

Learning and assessment will take place in an environment that is conducive to a learner's development, under direct supervision and controlled situation.

7. Learning outcome details**Learning outcome 1****Identify and state typical applications for common electrical and electronic components****Assessment criteria**

- 1.1 Given various common electrical and electronic components – resistors, capacitors and magnetic equipment, identify types and state typical application of each.
- 2.4 Given a selection of resistors identify their value and verify their colour coded values by measurement

Learning outcome 2**Apply basic physics to electrical fundamentals****Assessment criteria**

- 2.1 Describe the basic structure of matter and identify the particles participating in electric current flow.
- 2.2 Identify and state typical applications for common insulators and conductors.
- 2.3 Explain the following terms:
 electric charge
 electric current
 electric current in terms of charge
- 2.3 From results of laboratory exercises describe practical applications of:
 voltage sources
 factors effecting resistance

Learning Outcome 3

Describe the effects of electric current in terms of the conversion of electrical energy to other forms and the uses and the disadvantages of these effects.

- 3.1 Outline the basic principles by which electric current can result in the production of heat; the production of light; the production of magnetic fields; a chemical reaction.
- 3.2 List typical uses of the effects of current.
- 3.3 Describe the mechanisms by which metals corrode
- 3.4 Describe the fundamental principles (listed in AS 3000) for protection against the damaging effects of current.

Learning outcome 4

Use laboratory equipment to validate theoretical concepts

Assessment criteria

- 4.1 Construct simple series and parallel circuits from a schematic.
- 4.2 Use appropriate laboratory equipment to monitor circuit conditions.
- 4.3 Analyse recorded results to prove Ohm's Law, series and parallel V, I and R relationships and the power equation.

Learning outcome 5

Identify and outline the operation of basic electrical protection devices

Assessment criteria

- 5.1 Identify the purpose of protection devices.
- 5.2 Describe the basic construction and operation of fuses and basic circuit breakers.
- 5.3 Explain the operation of and necessity for 'safety switches'.
- 5.4 Explain the importance of isolating switches and the need for tagging such switches.
- 5.5 Explain the importance of earthing.

8. Delivery of the module

Delivery strategy

Delivery strategies must be suitable for learning both theoretical and practical aspects described in the module purpose. It is considered that the most effective way to achieve this is by the integration of theory and practice where learners learn by experimentation and through research and laboratory reports. It is recommended that learning and assessment be facilitated in a holistic manner, which may require learning outcome sequence other than that indicated in the module.

Resource requirements

Resources should be sufficient for learners to carry out experiments on an individual basis. This will require a range of experimental circuit devices and measuring instruments.

Useful references include:

Jenneson, J. R. 1995, *Electrical Principles for Electrical Trade*. 4th Ed. McGraw Hill, Sydney

Phillips, P. 1996, *Electrical Principles 1*. Thomas Nelson, Melbourne.

Batty, I. 1996, *Electrical Principles*. Prentice Hall, Sydney.

Van den Bergen, B. 1996, *Mathematics for the Electrical Trades*. TAFE Publications, RMIT, Melbourne.

Pethebridge, K., Neeson, I. 2001, *Electrical Wiring Practice*. 6th Ed. McGraw Hill, Sydney

Occupational health and safety requirements

A safe and healthy environment will be provided for learners and teachers as well as safety procedure with regard to learning / teaching activity.