

Title	Demonstrate and apply fundamental knowledge of electrical circuit engineering principles		
Level	3	Credits	15

Purpose	<p>This unit standard covers general fundamental electrical circuit theory and testing principles, and skills needed for electrotechnology engineering.</p> <p>People credited with this unit standard are able to demonstrate:</p> <ul style="list-style-type: none"> – and apply knowledge of basic DC circuit theory – and apply knowledge of DC circuit theory as applied to capacitors – and apply knowledge of elementary magnetic fields and electromagnets – knowledge of basic AC circuit theory – apply knowledge of electrical measuring instruments.
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Classification	Electrical Engineering > Core Electrical
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Available grade	Achieved
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Guidance Information

- 1 This unit standard is intended for use in engineering courses at diploma level with assessment primarily against laboratory assignments.
- 2 This unit standard is one of two that cover knowledge of electrical circuit engineering and provides a basis for Unit 22722, *Demonstrate and apply introductory knowledge of electrical circuit engineering principles*. It is recommended that competency in this unit standard be achieved before assessment against unit standard 22722 is attempted.
- 3 Reference
Health and Safety at Work Act 2015
and all subsequent amendments and replacements.
- 4 Definitions
A – ampere.
AC – alternating current.
C – capacitance.
DC – direct current.
EMF – electromotive force.
Fundamental knowledge – means employing some relevant theoretical knowledge of the subject matter with the ability to use that knowledge to interpret available information.

Industry practice – practice used and recommended by organisations involved in the electrotechnology industry.

R – resistance.

V – volt.

- 5 All measurements are to be expressed in Système International (SI) units, and, where required, converted from Imperial units into SI units.
- 6 All activities must comply with: any policies, procedures, and requirements of the organisations involved; the standards of relevant professional bodies; and any relevant legislative and/or regulatory requirements.
- 7 Range
 - a performance in relation to the outcomes of this unit standard must comply with the Health and Safety at Work Act 2015;
 - b laboratory and workshop safety practices are to be observed at all times.

Outcomes and performance criteria

Outcome 1

Demonstrate and apply knowledge of basic DC circuit theory.

Performance criteria

- 1.1 Concepts of EMF, voltage, and current are explained.
- 1.2 Concepts of resistance, Ohm's Law, power, and energy are explained.
- 1.3 Kirchhoff's laws are used to analyse simple resistor networks.

Range minimum of two DC sources and three resistors.
- 1.4 All branch currents and all node voltages are calculated for circuits containing resistors in series, parallel, and series-parallel.

Range evidence is required for – three series resistors, three parallel resistors, three resistors connected in a series-parallel combination.
- 1.5 Voltage dividers are used in practical applications.

Range minimum of three resistor networks.

Outcome 2

Demonstrate and apply knowledge of DC circuit theory as applied to capacitors.

Performance criteria

- 2.1 Capacitor operation in a DC circuit is explained using a simple constructional model and basic electrostatic principles.
- 2.2 The relationships between current, voltages, and time for a capacitor that is charged and discharged in a simple RC circuit are explained with the aid of diagrams.
- Range charge and discharge curves are calculated and verified experimentally; evidence for two resistance values and two capacitance values is required.

Outcome 3

Demonstrate and apply knowledge of elementary magnetic fields and electromagnets.

Performance criteria

- 3.1 Magnetic fields and permanent magnets are described.
- 3.2 Fields around current carrying conductors are described.
- 3.3 Faraday's law is stated, explained, and calculations performed.
- 3.4 Faraday's law is demonstrated experimentally.
- Range qualitatively only.

Outcome 4

Demonstrate knowledge of basic AC circuit theory.

Performance criteria

- 4.1 The nature of sinusoidal alternating voltages and currents are explained with the aid of diagrams.
- 4.2 The behaviour of capacitive reactive components in an AC circuit is described with the aid of diagrams.
- Range C in parallel and series with R; phasor diagrams are drawn for series and parallel RC circuits.
- 4.3 The operation of a double wound transformer is described with the aid of diagrams.
- Range calculation of turns ratio, voltage ratio, VA rating.

Outcome 5

Demonstrate and apply knowledge of electrical measuring instruments.

Range AC and DC voltage, AC and DC current, resistance, continuity, insulation resistance.

Performance criteria

5.1 Analogue and digital electrical measuring instruments are described in terms of their principles of operation and their applications.

Range instruments – multimeter, clip-on ammeter, insulation tester, DC ammeter, DC voltmeter, ohmmeter;
applications – AC and DC voltage and current, resistance, insulation, continuity, diode testing, use of series and parallel shunts, battery, potentiometer, other specialised functions.

5.2 Instruments are selected to match the type of measurement and inspected to ensure safety before testing.

5.3 Instruments are set and connected in accordance with manufacturers' specifications and in a manner that causes no danger to persons, instruments, or the equipment under test.

5.4 Measurements are taken and recorded in accordance with safe industry practice to ensure that components under test and test equipment are not damaged and personnel are not injured.

5.5 The approximate tolerance for each measurement is stated, in accordance with industry practice.

This unit standard is expiring. Assessment against the standard must take place by the last date for assessment set out below.

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	18 December 2006	31 December 2025
Rollover and Revision	2	15 March 2012	31 December 2025
Revision	3	15 January 2014	31 December 2025
Rollover and Revision	4	28 January 2021	31 December 2025
Review	5	27 April 2023	31 December 2025

Consent and Moderation Requirements (CMR) reference

0003

This CMR can be accessed at <http://www.nzqa.govt.nz/framework/search/index.do>.