National Certificate in Electronics Technology (Level 3)

Level **3**

Credits **40**

Purpose

This qualification builds on the National Certificate in Electronics Technology (Level 2) [Ref: 0240] and is designed for people interested in electronics who may wish to pursue further training and employment in this field. The qualification has been developed for use in two training environments particularly for people who have completed the National Certificate in Electronics Technology (Level 2) [Ref: 0240]:

- in senior secondary schools, where a one year course is offered at Year 13;
- in private training establishments and polytechnics, where it serves as a pre-employment qualification for those seeking employment in the electronics industry, or as the first stage in an apprenticeship in the electrotechnology industry.

The compulsory component recognises skills and knowledge in the construction, operation, and performance of:

- electronic programmable circuits
- electronic devices
- electronic prototypes.

The elective component allows candidates to select skills and knowledge relevant to their training needs and employment goals.

Elective 1 recognises skills and knowledge in electronics technology from a minimum of two of the following areas:

- electronic product development
- ADC and DAC digital electronic interface devices
- logic circuits.

Set A of Elective 2 recognises skills and knowledge in technology using specified achievement standards from the Technology – General Education domain. Set B recognises a range of skills and knowledge related to electronics technology from both achievement standards and unit standards.

After achieving the National Certificate in Electronics Technology (Level 3) [Ref: 1005], people interested in pursuing further training and employment in this field may wish to continue with any of the following:

- take up an apprenticeship in electronics or electrical industries and study for the National Certificates in Electronic Engineering at Levels 3 and 4 [Refs: 1093 and 1123] or the National Certificates in Electrical Engineering at Levels 2, 3, 4, and 5 [Refs: 0174, 0223, 1195, and 0951];
- study for the National Diploma in Engineering (Electrotechnology) (Level 6) [Ref: 1313];
- study for an engineering degree.

Special Notes

Recommended: National Certificate in Electronics Technology (Level 2) [Ref: 0240], or demonstrate equivalent knowledge and skills.

Credit Range

	Compulsory	Elective		
		Elective 1	Elective 2	
			Set A	Set B
Level 3 or above credits	13	6-9	18-21	18-21
Minimum totals	13	27		

Requirements for Award of Qualification

Summary of Requirements

- Compulsory standards
- Elective – A minimum of 27 credits as specified

Detailed Requirements

Compulsory
The following standards are required

Engineering and Technology > Electronic Engineering > Electronics Technology

ID	Title	Level	Credit
26119	Construct, and report on the performance of, a simple electronic programmable circuit	3	4
26120	Describe and construct circuits to demonstrate the operation and properties of electronic devices	3	3
26121	Plan, construct, modify, and report on an electronic prototype	3	6

Elective
A minimum of 27 credits at Level 3 or above
From the following sets
- Elective 1
- Elective 2

Elective 1
A minimum of 6 credits

Engineering and Technology > Electronic Engineering > Electronics Technology

ID	Title	Level	Credit
9221	Demonstrate knowledge of the development of an electronic product	3	3
26122	Demonstrate knowledge of and build circuits using digital electronic devices that interface with ADC and DAC functions	3	3
26123	Demonstrate knowledge of the practical applications of logic circuits	3	3

Elective 2
A minimum of 18 credits at Level 3 or above
From the following sets

- Set A
- Set B

Set A

Engineering and Technology > Technology > Technology - General Education

ID	Title	Level	Credit
90613	Develop a conceptual design to address a client issue	3	8
90620	Develop a one-off solution to address a client issue	3	8
90676	Describe technologists responsibilities to the wider community	3	4
90677	Analyse an existing multi-unit production process	3	4
90680	Explain knowledge that underpins an electronics and control technology outcome	3	4
90681	Demonstrate techniques in electronics and control technology	3	4
90684	Explain knowledge that underpins an information and communication technology outcome	3	4
90685	Demonstrate techniques in information and communication technology	3	4
90792	Develop a proposal for a production process for a client	3	6

Set B

Field	Subfield	Domain
Computing and Information Technology	Computing	Any
Engineering and Technology	Electrical Engineering	Any
	Electronic Engineering	Any
Sciences	Mathematics	Any
	Science	Chemistry
		Physics
		Science - Core
	Statistics and Probability	Any

Special Notes

1. **All standards listed below will be assessed at Achieved, Merit AND Excellence level in 2011.**

2. **External Standards – 3 credits required for NZQA course endorsement**

ID	Title	Level	Credit	Int/ Ext
90676	Describe technologists' responsibilities to the wider community	3	4	ext
90677	Analyse an existing multi-unit production process	3	4	ext
90680	Explain knowledge that underpins an electronics and control technology outcome	3	4	ext

STANDARDS

AS 9221 Internal

Demonstrate knowledge of the development of an electronic product

Level 3

Credits 3

Purpose This unit standard is intended for use in a senior secondary school environment, pre-employment electronics courses, or for the training and assessment of electronics technicians.

People credited with this unit standard are able to:
– demonstrate knowledge of the key stages undertaken by a manufacturing company in the development of an electronic product; and
– describe how teams work together to develop an electronic product.

Subfield Electronic Engineering

Domain Electronics Technology

Status Registered

Status date

Date version published

Planned review date 31 December 2012

Entry information Open.

Accreditation Evaluation of documentation and visit by NZQA and industry.

Standard setting body (SSB) ElectroTechnology Industry Training Organisation

Accreditation and Moderation Action Plan (AMAP) reference 0003

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

Special notes

1 This unit standard can be awarded with credit (achieved) or merit. For award with credit, all outcomes must be achieved as specified in the elements. For merit to be awarded, the candidate must meet the merit criteria specified in performance criterion 1.1.

2 Assessment definitions

Describe – for the purpose of this unit standard means to relate, recount, or characterise in sequence or story form. It typically involves single aspects related to phenomena, concepts, or principles.
Explain – for the purpose of this unit standard means to interpret and clarify points, or analyse causes where possible. It typically involves reasons.

3 Definitions
Electronic product – a functional device produced for sale that incorporates both hardware and embedded software.
Development of an electronic product – all stages of the development cycle.

Elements and performance criteria

Element 1

Demonstrate knowledge of the key stages undertaken by a manufacturing company in the development of an electronic product.

Performance criteria

1.1 The key stages in the development of an electronic product are described.

Range key stages:
development of a business case – concept development, market research, technical research, design, feasibility study;
development of a prototype – development of technical solution, building, testing;
manufacture – plant requirements, parts procurement and storage, assembly stages, product testing;
marketing – advertising, sales, distribution, technical support, customer support.
For merit – the candidate must describe *and* explain the key stages in the development of an electronic product. The explanation must include reasons for each key stage, consequences of not undertaking key stages, and the explanation must be based on an electronic product identified by make and/or model.

Element 2

Describe how teams work together to develop an electronic product.

Performance criteria

2.1 The functions of teams and their place in the process is described.

Range functions – software development, hardware development, mechanical engineering, electronic manufacturing, quality control.

2.2 The interaction between different teams that are instrumental in the development of a new electronic product is described.

Range interaction – communication, delegation of roles, reporting chain.

AS 26119 Internal

Construct and report on the performance of a simple electronic programmable circuit

Level **3**

Credits **4**

Purpose This unit standard is intended for use in a senior secondary school environment, pre-employment electronics courses, or for the training and assessment of electronics technicians.

People credited with this unit standard are able to:
- identify and select components from given samples to match a supplied schematic;
- construct a circuit based on a given specification for a simple electronic programmable circuit;
- programme a microcontroller; and
- report on the construction and performance of the circuit.

Subfield Electronic Engineering

Domain Electronics Technology

Status Registered

Status date

Date version published

Planned review date 31 December 2012

Entry information Recommended: Unit 18240, *Demonstrate knowledge of basic electronic components;* Unit 18241, *Demonstrate knowledge of basic electronic systems;* or demonstrate equivalent knowledge and skills.

Accreditation Evaluation of documentation and visit by NZQA and industry.

Standard setting body (SSB) ElectroTechnology Industry Training Organisation

Accreditation and Moderation Action Plan (AMAP) reference 0003

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

Special notes

1 This unit standard can be awarded with credit (achieved) or merit. For award with credit, all outcomes must be achieved as specified in the elements. For merit to be awarded, the candidate must meet the merit criteria specified in performance criterion 4.1.

2 Assessment definitions
Describe – for the purpose of this unit standard means to relate, recount, or characterise in sequence or story form. It typically involves single aspects related to phenomena, concepts, or principles.
Explain – for the purpose of this unit standard means to interpret and clarify points, or analyse causes where possible. It typically involves reasons.

3 Definitions
PCB – printed circuit board.
Simple electronic programmable circuit – for the purposes of this unit standard means a working electronic circuit comprising fewer than twenty components that incorporates analogue and/or digital hardware with software control.
Specification – document that describes the requirements for hardware and software of the circuit including key circuit values.

4 Range
a Circuit selection – one of the following: greenhouse controller; alarm system; sound effects generator; electronic game; any project submitted to and approved by ETITO for the purpose of this unit standard.
b Circuit to be constructed on a PCB prepared by the candidate.
c Candidates are expected to utilise the following prefixes: p *(x 10^{-12}), n (x 10^{-9}), μ(x 10^{-6}), m(x 10^{-3}), k(x 10^{3}), M(x 10^{6}).*
d All measurements are to be expressed in Système International (SI) units, and where required, converted from Imperial units into SI units.
e All activities must comply with any policies, procedures, and requirements of the organisations involved.
f Laboratory and workshop safety practices are to be observed at all times.
g A diary or log must be kept for each stage of the process and may include sketches, diagrams, schematics, photos, videos.

Elements and performance criteria

Element 1

Identify and select components from given samples to match a supplied schematic.

Performance criteria

1.1 Components are identified from given samples.

Range values, tolerances, pinouts.

1.2 Components are selected from given samples to match schematics.

Element 2

Construct a circuit based on a given specification for a simple electronic programmable circuit.

Performance criteria

2.1 A PCB is produced in accordance with circuit requirements.

2.2 Components are assembled and connected in circuit on the PCB to meet the requirements of the given specification.

Element 3

Programme a microcontroller.

Performance criteria

3.1 Programme structures are selected from a given range to meet the requirements of the specification.

3.2 A microcontroller is programmed to enable the circuit to perform to meet the requirements of the specification.

Element 4

Report on the construction and performance of the circuit.

Range report is based on the diary or log.

Performance criteria

4.1 The construction and performance of a simple electronic programmable circuit is described in a report.

Range hardware, software, key circuit values.
Circuit values may include but are not limited to one or more of – voltage, current, resistance, power, frequency, amplitude, gain.
For merit – the candidate must describe *and* explain the construction and performance of the circuit in the report. The explanation must include reference to the behaviour of the circuit in relation to the requirements of the given specification and it must provide possible reasons for any differences.

AS 26120 Internal

Describe and construct circuits to demonstrate the operation and properties of electronic devices

Level 3

Credits 3

Purpose This unit standard is intended for use in a senior secondary school environment, pre-employment electronics courses, or for the training and assessment of electronics technicians.

People credited with this unit standard are able to:
- describe the operation of basic semiconductor devices;
- construct one or more circuits to demonstrate the individual properties of basic electronic devices; and
- report on the construction and performance of the circuit(s).

Subfield Electronic Engineering

Domain Electronics Technology

Status Registered

Status date

Date version published

Planned review date 31 December 2012

Entry information Open.

Replacement information This unit standard replaced unit standard 19743.

Accreditation Evaluation of documentation and visit by NZQA and industry.

Standard setting body (SSB) ElectroTechnology Industry Training Organisation

Accreditation and Moderation Action Plan (AMAP) reference 0003

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

Special notes

1 This unit standard can be awarded with credit (achieved) or merit. For award with credit, all outcomes must be achieved as specified in the elements. For merit to be awarded, the candidate must meet the merit criteria specified in element 2.

2 Definitions
BJT – bipolar junction transistor.
IR – infrared.
LCD – liquid crystal display.
LDR – light dependent resistor.
LED – light emitting diode.
Microcontroller – an integrated, programmable device.
MOSFET – metal oxide semiconductor field effect transistor.
N-type – negative type semiconductor.
Op-amp – operational amplifier.
P-type – positive type semiconductor.
RF – radio frequency.

3 Range
a Basic electronic devices include but are not limited to:
Discrete components – reed switch, LDR, thermistor, Hall-effect device, BJT, motor (pulse-width modulation control), 7-segment display, IR diode;
Integrated components – 555 astable or 555 monostable, gates, op-amp (comparator), op-amp (inverting amplifier), op-amp (non-inverting amplifier), LCD, RF transmitter, RF receiver, IR receiver/decoder, microcontroller.
b All activities must comply with any policies, procedures, and requirements of the organisations involved.
c Laboratory and workshop safety practices are to be observed at all times.
d A diary or log must be kept for each stage of the process and may include sketches, diagrams, schematics, photos, videos.

Elements and performance criteria

Element 1

Describe the operation of basic semiconductor devices.

Performance criteria

1.1 The properties of semiconductor materials are described based on their structure.

Range n-type semiconductor, p-type semiconductor, electron flow, hole flow.

1.2 The operation of basic electronic devices is described in terms of their semiconductor makeup.

Range silicon diode, LED, BJT, LDR, n-channel MOSFET. Evidence of three is required.

Element 2

Construct one or more circuits to demonstrate the individual properties of basic electronic devices.

Range evidence of three discrete and three integrated devices is required.
Up to six circuits may be constructed.
For merit – the candidate must demonstrate the separate functions of all six electronic devices by utilising them in no more than three circuits.

Performance criteria

2.1 Constructed circuit(s) demonstrate the properties of basic electronic devices.

Element 3

Report on the construction and performance of the circuit(s).

Range report is based on the diary or log.

Performance criteria

3.1 The construction of each circuit is described in a report.

3.2 The performance of each circuit is described in a report.

AS 26121 Internal

Plan, construct, modify, and report on an electronic prototype

Level 3

Credits 6

Purpose This unit standard is intended for use in a senior secondary school environment, pre-employment electronics courses, or for the training and assessment of electronics technicians.

People credited with this unit standard are able to:
- develop a project plan to cover the stages of the design, construction, and modification of a working prototype of an electronic product;
- identify and utilise basic electronic components and processes to construct an electronic prototype;
- modify the prototype; and
- report on the development and performance of the prototype and modified prototype.

Subfield Electronic Engineering

Domain Electronics Technology

Status Registered

Status date

Date version published

Planned review date 31 December 2012

Entry information Recommended: Unit 26119, *Construct and report on the performance of a simple electronic programmable circuit;* Unit 26120, *Describe and construct circuits to demonstrate the operation and properties of electronic devices;* or demonstrate equivalent knowledge and skills.

Accreditation Evaluation of documentation and visit by NZQA and industry.

Standard setting body (SSB) ElectroTechnology Industry Training Organisation

Accreditation and Moderation Action Plan (AMAP) reference 0003

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

Special notes

1 This unit standard can be awarded with credit (achieved) or merit. For award with credit, all outcomes must be achieved as specified in the elements. For merit to be awarded, the candidate must meet the merit criteria specified in performance criterion 4.1.

2 Assessment definitions
Describe – for the purpose of this unit standard means to relate, recount, or characterise in sequence or story form. It typically involves single aspects related to phenomena, concepts, or principles.
Explain – for the purpose of this unit standard means to interpret and clarify points, or analyse causes where possible. It typically involves reasons.

3 Definitions
Gantt Chart – a horizontal bar chart that illustrates a project schedule.
IR – infrared.
LCD – liquid crystal display.
Mockup – may include interim breadboarded circuits or simulation and emulation programmes, such as Crocodile Clips (hardware) or PICAXE Programme Editor software.
Modification brief – document that specifies outcomes, including altered function and expected key circuit values for the prototype.
Op-amp – operational amplifier.
RF – radio frequency.
Specification – document that describes the requirements for hardware and software of the prototype, including the values of key circuit variables.

4 Evidence presented for assessment against this unit standard must be based on a negotiated and approved project specification with and by the assessor.

5 Work for this unit standard may be carried out as part of a small group. Each candidate must present evidence of individual competence against the elements of this unit standard.

6 Range
a Circuit values may include one or more of – voltage, current, resistance, power, frequency, amplitude, gain.
b The prototype must include at least four transducers, with at least one integrated device selected from the following: 555 astable or 555 monostable, gates, op-amp (comparator), op-amp (inverting amplifier), op-amp (non-inverting amplifier), LCD, RF transmitter, RF receiver, IR receiver/decoder. The prototype must utilise embedded programming (programmed microcontroller) incorporated into a suitable final package with an effective user interface.
c Project components are to be assembled and soldered on a printed circuit board in accordance with electronics industry standards.
d The prototype needs to be functional and must be housed in an appropriate container, with an effective user interface.
e The embedded programme should reflect best practice in algorithm selection, programme structure, and annotation.

f All activities must comply with any policies, procedures, and requirements of the organisations involved.
g Laboratory and workshop safety practices are to be observed at all times.
h A diary or log must be kept for each stage of the process and may include sketches, diagrams, schematics, photos, videos.

Elements and performance criteria

Element 1

Develop a project plan to cover the stages of the design, construction, and modification of a working prototype of an electronic product.

Performance criteria

1.1 A project management tool is selected to enable project planning.

Range Gantt chart or equivalent.

1.2 A project plan is developed to meet the requirements of an approved specification.

Range project plan includes – timelines, task breakdown, reporting milestones, resources required, budget.
Project plan may include – roles, responsibilities.

Element 2

Identify and utilise basic electronic components and processes to construct an electronic prototype.

Performance criteria

2.1 Electronic components and processes suitable for the development of the prototype are identified to meet the requirements of a given specification and project plan.

2.2 Electronic or mockup trials are conducted to test and refine the concept to meet the requirements of a given specification and project plan.

2.3 Electronic components and processes are utilised to construct a prototype to meet the requirements of a given specification and project plan.

Range soldering to industry standard, tidy board layout, annotated programme, suitable container, effective user interface.

2.4 Tests confirm that the prototype meets the requirements of the specification.

Element 3

Modify the prototype.

Performance criteria

3.1 The prototype is modified to meet the requirements of a given modification brief.

3.2 The prototype is evaluated against the modification brief.

Element 4

Report on the development and performance of the prototype and modified prototype.

Range report is based on the diary or log.

Performance criteria

4.1 The development process and performance of the prototype and modified prototype is described in a report.

For merit – the candidate must describe *and* explain the development process and performance of the prototype and modified prototype in the report. The explanation must include reference to the behaviour of the prototype and modified prototype in relation to the requirements of the given specification and modification brief and it must provide possible reasons for any differences.

AS 26122 Internal

Demonstrate knowledge of and build circuits using digital electronic devices that interface with ADC and DAC functions

Level 3

Credits 3

Purpose This unit standard is intended for use in a senior secondary school environment, pre-employment electronics courses, or for the training and assessment of electronics technicians.

People credited with this unit standard are able to:
- describe the operation of digital electronic devices;
- demonstrate knowledge of the operation of ADC and DAC circuits and analogue-digital interconversion; and
- construct circuits to demonstrate how digital electronic devices can be linked to ADC or DAC functions.

Subfield Electronic Engineering

Domain Electronics Technology

Status Registered

Status date

Date version published

Planned review date 31 December 2012

Entry information Open.

Replacement information This unit standard replaced unit standard 19744.

Accreditation Evaluation of documentation and visit by NZQA and industry.

Standard setting body (SSB) ElectroTechnology Industry Training Organisation

Accreditation and Moderation Action Plan (AMAP) reference 0003

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

Special notes

1 This unit standard can be awarded with credit (achieved) or merit. For award with credit, all outcomes must be achieved as specified in the elements. For merit to be awarded, the candidate must meet the merit criteria specified in performance criterion 2.4.

2 Assessment definitions
Describe – for the purpose of this unit standard means to relate, recount, or characterise in sequence or story form. It typically involves single aspects related to phenomena, concepts, or principles.
Explain – for the purpose of this unit standard means to interpret and clarify points, or analyse causes where possible. It typically involves reasons.

3 Definitions
ADC – analogue-digital conversion.
DAC – digital-analogue conversion.
Digital electronic devices – integrated circuits with discrete functions such as buffer, inverter, monostable, astable, Schmitt trigger, half-adder, decoder/driver, JK-flipflop.
Working circuits – the operation of the device can be clearly demonstrated.

4 Range
a All activities must comply with any policies, procedures, and requirements of the organisations involved.
b Laboratory and workshop safety practices are to be observed at all times.

Elements and performance criteria

Element 1

Describe the operation of digital electronic devices.

Range evidence of four devices is required.

Performance criteria

1.1 The operation of digital electronic devices is described in terms of input, output, and process.

1.2 One practical application for each digital electronic device is described.

Element 2

Demonstrate knowledge of the operation of ADC and DAC circuits and analogue-digital interconversion.

Performance criteria

2.1 Analogue and digital information are described and a distinction drawn between them.

2.2 The operation of a three-bit ADC circuit is described.

2.3 The operation of a three-bit DAC circuit is described.

2.4 Analogue-digital and digital-analogue converts are described.

For merit – the candidate must describe *and* explain analogue-digital interconversion. The explanation must include examples of analogue-digital interconversion in three practical applications.

Element 3

Construct circuits to demonstrate how digital electronic devices can be linked to ADC or DAC functions.

Range a microcontroller may be programmed to satisfy the ADC and DAC functions. Evidence of four devices is required.

Performance criteria

3.1 Circuits are constructed to demonstrate how digital electronic devices can be linked to ADC or DAC functions.

AS 26123 Internal

Demonstrate knowledge of the practical applications of logic circuits

Level **3**

Credits **3**

Purpose This unit standard is intended for use in a senior secondary school environment, pre-employment electronics courses, or for the training and assessment of electronics technicians.

People credited with this unit standard are able to:
– demonstrate knowledge of logic circuits; and
– construct compound logic circuits and demonstrate knowledge of their applications.

Subfield Electronic Engineering

Domain Electronics Technology

Status Registered

Status date

Date version published

Planned review date 31 December 2012

Entry information Open.

Accreditation Evaluation of documentation and visit by NZQA and industry.

Standard setting body (SSB) ElectroTechnology Industry Training Organisation

Accreditation and Moderation Action Plan (AMAP) reference 0003

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

Special notes

1 This unit standard can be awarded with credit (achieved) or merit. For award with credit, all outcomes must be achieved as specified in the elements. For merit to be awarded, the candidate must meet the merit criteria specified in performance criterion 2.2.

2 Assessment definitions

Describe – for the purpose of this unit standard means to relate, recount, or characterise in sequence or story form. It typically involves single aspects related to phenomena, concepts, or principles.
Explain – for the purpose of this unit standard means to interpret and clarify points, or analyse causes where possible. It typically involves reasons.

3 Definitions

Boolean logic – for the purpose of this unit standard means the logic expressed by a suitable truth table.
Boolean logic functions:
AND – the Boolean function that is true only if all its arguments are true.
NAND – Not AND, the Boolean function that is true unless both its arguments are true, the logical complement of AND.
NOR – Not OR, the Boolean function that is true if none of its inputs are true and none of its inputs are false. It is the logical complement of inclusive OR.
NOT – the Boolean function that is true only if its input is false.
OR – the Boolean function that is true if any of its arguments are true.
XOR – exclusive OR gate, a two-input Boolean logic function with an output that is true if one input is true and the other is false.
Compound logic circuit – for the purpose of this unit standard means a circuit comprised of at least four logic functions, at least three of which are different.
Discrete – composed of single entities such as transistors, capacitors, resistors, or inductors.
Half-adder – a logic circuit that performs an addition operation on two one-bit binary numbers.
Logic gates – circuits that perform Boolean logic operations that may be discrete or PLA-based.
PLA – programmable logic array.
Specification – document that describes the requirements for hardware and software of the prototype, including the values of key circuit variables.
Truth tables –mathematical tables used to define Boolean logic operations.

4 Range

a All activities must comply with any policies, procedures, and requirements of the organisations involved.
b Laboratory and workshop safety practices are to be observed at all times.

Elements and performance criteria

Element 1

Demonstrate knowledge of logic circuits.

Performance criteria

1.1 Binary terminology is described.

Range up to and including 8 bit numbers.

1.2 Truth tables are used to describe simple logic gates.

Range AND, OR, NOT, NAND, NOR, XOR, half-adder.

1.3 The functions of simple logic gate circuits are demonstrated.

Range AND, OR, NOT, NAND, NOR, XOR, half-adder.

Element 2

Construct compound logic circuits and demonstrate knowledge of their applications.

Range evidence of two circuits is required.

Performance criteria

2.1 Compound logic circuits are constructed to a given specification and their truth tables drawn.

2.2 One practical application for each compound logic circuit is described.

For merit – the candidate must describe *and* explain practical applications for the given compound logic circuits.

Achievement Standard AS90680

Subject Reference	Electronics and Control Technology 3.6				
Title	Explain knowledge that underpins an electronics and control technology outcome				
Level	3	**Credits**	4	**Assessment**	External
Subfield	Technology				
Domain	Technology – General Education				
Registration date	18 January 2006	**Date version published**		22 February 2006	

This achievement standard involves explaining knowledge that underpins the development of an existing electronics and control technology outcome.

Achievement Criteria

Achievement	Achievement with Merit	Achievement with Excellence
• Explain the knowledge that underpins the development of an existing electronics and control technology outcome.	• Explain the underpinning knowledge and how it has been synthesised in the development of an existing electronics and control technology outcome.	• Discuss the underpinning knowledge and how it has been synthesised in the development of two or more existing electronics and control technology outcomes.

Explanatory Notes

1 This achievement standard is derived from *Technology in the New Zealand Curriculum*, Learning Media, Ministry of Education, 1995, Level 8; and *Hangarau i roto i te Marautanga o Aotearoa,* Te Pou Taki Kōrero,Te Tāhuhu o te Mātauranga, 1999.

2 Appropriate reference information is available in *Safety and Technology Education: A Guidance Manual for New Zealand Schools,* Learning Media, Ministry of Education, 1998; and the *Health and Safety Code of Practice for State Primary, Composite and Secondary Schools,* Learning Media, Ministry of Education, 1993.

3 *An existing electronics and control technology outcome* is one that has been developed and implemented by a technologist(s). A *technologist* is defined as a professional involved in the design and/or development of a technological outcome. The student cannot be the technologist.

4 *Knowledge* that underpins the development of an existing electronics and control technology outcome includes such things as:

- knowledge of the key resources (including such things as people, time, components, and materials) that have been used
- knowledge of codes of practice, codes of ethics, and legislation
- knowledge from other disciplines, eg science, social science, arts
- techniques and procedures used to develop and implement the technological outcome.

5 *Explain* means describe in detail giving reasons.
Discuss means compare and contrast.
Synthesise refers to the ability to bring together knowledge, skills, ideas and methods from different sources to advance one's practice but not necessarily to produce a more complex outcome. This emphasis is about knowledge and the way it is used, not the quality of the outcome. Therefore, for achievement with merit or achievement with excellence, the student is able to demonstrate access to a wide variety of knowledge and the discerning use of knowledge relevant to the existing technological outcome.

Achievement Standard AS 90677

Subject Reference	Technology 3.5				
Title	Analyse an existing multi-unit production process				
Level	3	**Credits**	4	**Assessment**	External
Subfield	Technology				
Domain	Technology – General Education				
Registration date	18 January 2006	**Date version published**	22 February 2006		

This achievement standard focuses on analysing an existing multi-unit production process to identify and describe influences on key stages, and how the development and continuance of production processes impacts on key stakeholders and the environment.

Achievement Criteria

Achievement	Achievement with Merit	Achievement with Excellence
• Analyse an existing multi-unit production process to identify and describe influences on key stages.	• Analyse an existing multi-unit production process to identify and explain influences on key stages.	• Analyse and critique two or more existing multi-unit production processes to identify and discuss influences on the key stages of the production processes.
• Describe the development and continuance of production processes, and their impact on key stakeholders and the environment.	• Explain how the development and continuance of production processes impacts differently on key and wider-community stakeholders and the environment.	• Discuss how the development and continuance of production processes impacts differently on key and wider-community stakeholders and the environment in terms of their sustainability and management.

Explanatory Notes

1 This achievement standard is derived from *Technology in the New Zealand Curriculum*, Learning Media, Ministry of Education, 1995, Level 8; and *Hangarau i roto i te Marautanga o Aotearoa,* Te Pou Taki Kōrero, Te Tāhuhu o te Mātauranga, 1999.

2 Appropriate reference information is available in *Safety and Technology Education: A Guidance Manual for New Zealand Schools,* Learning Media, Ministry of Education,

1998; and the *Health and Safety Code of Practice for State Primary, Composite and Secondary Schools,* Learning Media, Ministry of Education, 1993.

3 *Analysis of existing multi-unit production processes* to determine influences would require an exploration of such things as:

- inputs, outputs and yields
- the purpose of operations – storage, transport, delay, inspection or transformation operations (with description of the transformation)
- levels of key operating variables that need to be maintained (eg temperature, linear measurement, volume) the limiting (bottleneck) aspect of stages
- sub-setting for sequential and parallel operations
- use of flow-sheeting
- inventory management systems
- limitations imposed by legislation, regulations or codes of practice, and societal and ethical parameters such as religious beliefs and philosophical positions.

4 *Key stages* are used for sub-setting a multi-unit production process to enable management of resources (including labour) and quality review.

5 *Sustainability* refers to such things as social, political, and environmental impacts, availability of resources, and economic feasibility. Sustainability considers process efficiency concerned with minimising inputs such as energy and labour, and/or maximising useful outputs such as waste reduction.

6 *Key stakeholders* include people who are directly implicated in the production processes (eg owners, workers on the production site, suppliers of key resources), and the immediate environment where the production process will be located.

7 *Wider-community stakeholders* are those who are or may be indirectly implicated in the existing production process. Impacts on wider-community stakeholders could include, but are not limited to, the need for lifestyle change, changes to their environment, health issues, and economic, cultural and political impacts.

8 *Explain* means describe in detail giving reasons.
Discuss means compare and contrast.

Achievement Standard AS 90676

Subject Reference	Technology 3.4				
Title	Describe technologists' responsibilities to the wider community				
Level	3	**Credits**	4	**Assessment**	External
Subfield	Technology				
Domain	Technology – General Education				
Registration date	18 January 2006	**Date version published**	22 February 2006		

This achievement standard focuses on describing responsibilities (including legal, ethical and moral) to the wider community and the impact this has on the practice undertaken by different technologists.

Achievement Criteria

Achievement	Achievement with Merit	Achievement with Excellence
• Describe technologists' responsibilities to the wider community and the impact of these on their practice.	• Explain technologists' responsibilities to the wider community and the impact of these on their practice.	• Discuss technologists' responsibilities to the wider community and the impact of these on their practice.

Explanatory Notes

1 This achievement standard is derived from *Technology in the New Zealand Curriculum*, Learning Media, Ministry of Education, 1995, Level 8; and *Hangarau i roto i te Marautanga o Aotearoa,* Te Pou Taki Kōrero, Te Tāhuhu o te Mātauranga, 1999.

2 Appropriate reference information is available in *Safety and Technology Education: A Guidance Manual for New Zealand Schools,* Learning Media, Ministry of Education, 1998; and the *Health and Safety Code of Practice for State Primary, Composite and Secondary Schools,* Learning Media, Ministry of Education, 1993.

3 A *technologist* is defined as a professional involved in the design and/or development of technological outcomes. The technologist cannot be the student. *Technologists* means two or more different technologists.

4 Responsibilities to the *wider community* include:
- legal responsibilities including:
  - Acts (eg Fair Trading Act 1986, Consumer Guarantees Act 1993, Health and Safety in Employment Act 1992, Privacy Act 1993, Employment Relations

Act 2000, Resource Management Act 1991, Hazardous Substances and New Organisms Act 1996)
    - Standards (eg ISO standards – 9000, 14000 series, Standards New Zealand (SNZ) standards)
- ethical responsibilities including:
    - professional (eg stipulated by codes of ethics developed by professional associations)
    - cultural and/or religious protocols (eg in keeping with the accepted practices of cultures and religions)
- moral responsibilities driven by the beliefs and values of the technologist.

5 *Impacts of the responsibilities to the wider community on practice* may involve:

- appraisal of technologists' practice
- understanding of how operating practices, beliefs, values and ethics in the wider community promotes and/or constrains the technologists' practice.

6 *Explain* means describe in detail giving reasons.
Discuss means compare and contrast