Title	**Demonstrate and apply advanced knowledge of microcontroller engineering concepts**		
Level	**6**	**Credits**	**15**

Purpose	This unit standard covers microcontroller system software development, peripheral devices interfacing, modular design, and application design. People credited with this unit standard are able to: – apply microcontroller hardware technology to a given application; – analyse and implement the operation of off-chip peripherals; – and use microcontroller development tools; – investigate testing strategies and programming techniques for conformance to specification and fault tolerance; and – develop a working software solution to meet a given specification using techniques to aid testing and fault tolerance.

Classification	Electronic Engineering > Core Electronics

Available grade	Achieved

Guidance Information

1 This unit standard is intended for use in engineering courses at diploma level.

2 This unit standard is one of two that cover knowledge of electrical circuit engineering the other being Unit 22728, *Demonstrate and apply intermediate knowledge of microcontroller engineering concepts*, which this unit standard builds on. It is recommended that competency in unit standard 22728 be achieved before assessment against this unit standard is attempted, or equivalent knowledge and skills demonstrated.

3 Reference
Health and Safety in Employment Act 1992;
and all subsequent amendments and replacements.

4 Definitions
ADC – analogue digital converter.
Advanced knowledge – means employing specialised knowledge, with depth in more than one area of the subject matter, to analyse, reformat, and evaluate a wide range of information.
CPU – central processing unit.
d.c. – direct current.

I/O – input/output.
I2C – inter-integrated circuit.
ICE – in-circuit emulator.
IDE – integrated development environment.
Industry practice – practice used and recommended by organisations involved in the electrotechnology industry.
LIN – local interconnect network.
POST – power on self test.
SPI – serial peripheral interface.

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 elements of this unit standard must comply with the Health and Safety in Employment Act 1992;
b laboratory and workshop safety practices are to be observed at all times.

Outcomes and performance criteria

Outcome 1

Apply microcontroller hardware technology to a given application.

Performance criteria

1.1 Physical and commercial microcontroller hardware constraints are identified and considered against a design brief and data sheets.

Range may include but is not limited to – microcontroller family, clock speed, memory, hardware/software response times, on-off board peripheral I/O, cost, software/hardware trade-off, development tools, manufacturing quantity.

1.2 Microcontroller hardware technology is applied to a given application in accordance with industry practice.

Outcome 2

Analyse and implement the operation of off-chip peripherals.

Range may include but is not limited to – I2C, SPI, single wire bus, LIN.

Performance criteria

2.1 The operation of off-chip peripherals is analysed and the results are used to implement their operation in accordance with industry practice.

Range evidence of input and output devices is required.

Outcome 3

Select and use microcontroller development tools.

Performance criteria

3.1 The characteristics and areas of application of different microcontroller development tool features are explained in accordance with industry practice.

Range may include but is not limited to – ICE, software simulator, low and high level debugging, evaluation board cost considerations.

3.2 Development tools are used to develop a software program that satisfies a design brief in accordance with industry practice.

Range at least two different development tools.

Outcome 4

Investigate testing strategies and programming techniques for conformance to specification and fault tolerance.

Performance criteria

4.1 Testing strategies and techniques are described in accordance with specification requirements and industry practice.

Range project simulation, on-board diagnosis, I/O exercising.

4.2 Fault tolerance methods are consistent with the specification.

Range may include but is not limited to – watch dog timer and tasks, POST, microcontroller supervisory power control chip.

Outcome 5

Develop a working software solution to meet a given specification using techniques to aid testing and fault tolerance.

Range high-level or assembly language is written, debugged and documented, that can control at least three peripheral devices using interrupts.

Performance criteria

5.1 Software for a microcontroller is developed to meet a given specification.

5.2 Different programming techniques applicable to microcontroller systems are explained and applied to either on board or off board peripheral devices to aid testing and fault indication.

Range polled main loop, event driven.

5.3 The software solution is documented 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 2024
Review	2	25 May 2023	31 December 2024

Consent and Moderation Requirements (CMR) reference	0003

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