Title	**Demonstrate and apply advanced knowledge of instrumentation and control principles**		
Level	**6**	**Credits**	**15**

Purpose	This unit standard covers advanced industrial measurement and control systems and includes detailed measurement and control strategies, advanced control systems, and elementary process modelling. People credited with this unit standard are able to: – demonstrate knowledge of and apply process measurement; – demonstrate knowledge of, and use final control elements, mathematical models and advanced control strategies; and – develop a practical measurement and control process to a given specification.

Classification	Industrial Measurement and Control > Industrial Measurement and Control - Theory

Available grade	Achieved

Guidance Information

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

2 This unit standard is one of two that cover the concepts used in industrial measurement and control systems for engineers, the other being Unit 22743, *Demonstrate and apply intermediate knowledge of instrumentation and control system engineering*, which this unit standard builds on. It is recommended that competency in unit standard 22743 be achieved before assessment against this unit standard is attempted, or equivalent knowledge and skills demonstrated.

3 Reference
Health and Safety at Work Act 2015;
and all subsequent amendments and replacements.

4 Definitions
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.
Industry practice – practice used and recommended by organisations involved in the electrotechnology industry.
ρgh – hydrostatic pressure.

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 knowledge of and apply process measurement.

Performance criteria

1.1 The basic physical principles of process measurements are described and applied in accordance with industry practice.

Range pressure = ρgh; equation of continuity; Bernouilli's equation; Ideal gas law, mass and energy conservation.

1.2 Systems used to make measurements of process variables are described in accordance with industry practice.

Range pressure, temperature, flow, level, displacement, velocity; system process connections, sensing element, transmitter.

Outcome 2

Demonstrate knowledge of, and use final control elements, mathematical models, and advanced control strategies.

Performance criteria

2.1 The principles, operation, and applications of final control elements are described in accordance with industry practice.

Range control valves, variable speed drives.

2.2 Mathematical models of physical processes are used and interpreted in accordance with industry practice.

Range derivation and use of differential equations to model simple first-order systems; identify time constant and process gain from differential equation or transfer function.

2.3 Advanced control modes are explained in accordance with industry practice.

Range control modes may include but are not limited to – cascade, feed-forward/ratio, adaptive, split-range, multivariable, fuzzy.

2.4 Advanced control modes are used in practical applications in accordance with industry practice.

Range may include but is not limited to – cascade, feed-forward/ratio, adaptive, split-range, multivariable, fuzzy.

Outcome 3

Develop a practical measurement and control process to a given specification.

Range may include but is not limited to – flow element characteristics, differential pressure, velocity; level measurement using differential pressure transmitter; implementation of advanced control methods; effect of loop delays on stability.

Performance criteria

3.1 A plan is developed in accordance with the specification.

3.2 Apparatus is constructed and operated in accordance with industry practice.

3.3 Results are recorded in a presentable format 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 2027
Rollover and Revision	2	28 June 2018	31 December 2027
Review	3	30 January 2025	31 December 2027

Consent and Moderation Requirements (CMR) reference	0003

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