Title	**Demonstrate and apply knowledge of analogue principles for electronics technicians**		
Level	**4**	**Credits**	**12**

Purpose	People credited with this unit standard are able to demonstrate knowledge of: – small signal Class A amplifier circuits using bipolar and field effect transistors; – emitter follower or source follower amplifier circuits; – power amplifiers; – differential amplifiers and associated circuits; – feedback in electronic circuits; – sine wave oscillators; – filter concepts; and – apply knowledge of analogue electronics principles.

Classification	Electronic Engineering > Core Electronics

Available grade	Achieved

Guidance Information

1 References
Electricity Act 1992;
Electricity (Safety) Regulations 2010;
EWRB *Rules of the Board* and *Teaching Guidelines* available at www.ewrb.govt.nz;
Health and Safety at work Act 2015;
and all subsequent amendments and replacements.

2 Definitions
CR – capacitance and resistance.
Industry practice – those practices that competent practitioners within the Electronic Engineering industry recognise as current industry best practice.
MOSFET – metal oxide field effect transistor.

3 Range
a Electrical, radiation, and workshop or laboratory safety practices are to be observed at all times.
b All measurements are to be expressed in Système Internationale (SI) units and multipliers.
c Candidates are expected to have memorised and to be able to use the following formula:

$$A_{CL} = \frac{A_{OL}}{1 + \beta . A_{OL}}$$

c All activities and evidence presented for all outcomes and performance criteria in this unit standard must be in accordance with:
   i legislation;
   ii policies and procedures;
   iii ethical codes;
   iv Standards – may include but are not limited to those listed in Schedule 2 of the Electricity (Safety) Regulations 2010;
   v EWRB Rules of the Board;
   vi safe and sound practice;
   vii applicable site, company, and industry practice, and industry conventions.

Outcomes and performance criteria

Outcome 1

Demonstrate knowledge of small signal Class A amplifier circuits using bipolar and field effect transistors.

Performance criteria

1.1 Calculate resistor values to select an operating point for linear operation in Class A.

Range common emitter 4 resistor biasing, common source MOSFET biasing.

1.2 Calculate the small signal parameters for amplifier circuits.

Range circuits – common emitter, common source;
parameters – input and output impedance, voltage gain, current gain, power gain.

1.3 Explain capacitive and transformer coupling between amplifier stages, with reference to circuit sketches and frequency effects.

1.4 Explain the effect on gain and frequency response of the emitter or source by-pass capacitor.

Outcome 2

Demonstrate knowledge of emitter follower or source follower amplifier circuits.

Performance criteria

2.1 Sketch a basic amplifier circuit.

2.2 Identify advantages and disadvantages compared to common emitter or common source circuits.

2.3 Calculate voltage gain and input and output impedances.

Outcome 3

Demonstrate knowledge of power amplifiers.

Range Classes A, B (push-pull and complementary pair), AB, C, D.

Performance criteria

3.1 Determine power amplifier class by inspection, using given circuit diagrams.

3.2 Explain the classes of power amplifiers and the circuit operation of each in terms of load line and operating point, with given circuit diagrams.

3.3 Draw sketches of input and output waveforms.

3.4 Identify and compare features of each class of power amplifier.

Outcome 4

Demonstrate knowledge of differential amplifiers and associated circuits.

Performance criteria

4.1 Identify the characteristic features of differential amplifiers.

4.2 Explain the circuit operation of a discrete component differential amplifier with reference to differential gain, common mode rejection, and the purpose of each component.

4.3 Explain the characteristics and operation of constant current source and current mirror circuits and identify the reasons for their use in conjunction with differential amplifiers.

Outcome 5

Demonstrate knowledge of feedback in electronic circuits.

Performance criteria

5.1 Explain the concept and purpose of negative and positive feedback.

5.2 Explain the terms open loop, closed loop, feedback fraction, and loop gain, and describe and apply the feedback formula $A_{CL} = \frac{A_{OL}}{1 + \beta . A_{OL}}$.

5.3 Describe methods of applying negative feedback using block diagrams and identify them in operational amplifier circuits.

Range methods – voltage series, current series, voltage shunt, current shunt;
circuits – voltage shunt inverting op-amp circuit, voltage series non-inverting op-amp circuit.

5.4 Explain the effect of negative feedback on amplifier parameters.

Range parameters – gain, bandwidth, input and output impedance, distortion.

5.5 Explain the need for stability in an amplifier and identify the conditions for stability.

Outcome 6

Demonstrate knowledge of sine wave oscillators.

Range oscillators may include – Hartley, Colpitts, Pierce, CR phase shift, variable capacitance tuned, Wien bridge;
evidence of two oscillators is required.

Performance criteria

6.1 Identify the type of oscillator and the frequency determining components by inspection of a given circuit diagram.

Outcome 7

Demonstrate knowledge of filter concepts.

Performance criteria

7.1 Identify filter types and sketch their Bode plots.

Range filter types – band pass, band stop, low pass, high pass.

7.2 Calculate cut-off frequencies for simple filters.

Range two calculations.

7.3 Explain the operation of a simple passive bass and treble tone control circuit and identify the component block, with given circuit diagram.

Range component blocks – treble boost, treble cut, bass boost, bass cut.

Outcome 8

Apply knowledge of analogue electronics principles.

Range application must relate to the preceding outcomes and may include but is not limited to – circuit construction, experiment, fault finding, or project.

Performance criteria

8.1 Apply knowledge of analogue electronics principles to use instruments, tests, and experimental procedure.

8.2 Produce measurements and observations relevant to the application.

8.3 Record purpose, method, observations, measurements, and conclusions in accordance with a given format.

Planned review date	31 December 2025

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	26 July 2004	31 December 2012
Review	2	21 July 2011	31 December 2022
Review	3	24 June 2021	N/A

Consent and Moderation Requirements (CMR) reference	0003

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

Comments on this unit standard

Please contact The Skills Organisation reviewcomments@skills.org.nz if you wish to suggest changes to the content of this unit standard.