SCQF level 5
Unit Specification

Electronics: Circuit Design

SCQF: level 5 (6 SCQF credit points)

Unit code: JQCC 75

Unit outline

The general aim of this Unit is to develop an understanding of key electrical and electronic components, and how they can be combined into electronic circuits. Learners will analyse electronic problems and design solutions to these problems. In addition, learners will explore some aspects of the impact of electronics on society and the environment.

Learners who complete this Unit will be able to:

1 Design a range of digital electronic circuits
2 Design a range of analogue electronic circuits
3 Describe aspects of the impact of electronics

This Unit is available as a free-standing Unit. The Unit Specification should be read in conjunction with the Unit Support Notes, which provides advice and guidance on delivery, assessment approaches and development of skills for learning, skills for life and skills for work. Exemplification of the standards in this Unit is given in the Unit Assessment Support.

Recommended entry

Entry to this Unit is at the discretion of the centre. However, learners would normally be expected to have attained the skills, knowledge and understanding required by one or more of the following or equivalent qualifications and/or experience:

- Electronics: Circuit Design (National 4)
- Numeracy (National 4)

Equality and inclusion

This Unit Specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence. For further information, please refer to the Unit Support Notes.

Standards

Outcomes and assessment standards

Outcome 1

The learner will:

1 Design a range of digital electronic circuits by:

1.1 Analysing problems requiring digital solutions
1.2 Using multi-input combinational logic involving AND, OR, NOT, NAND, XOR and NOR
1.3 Combining components and/or sub-systems into complete circuit designs
1.4 Describing accurately how a range of familiar and less familiar digital circuits work, using appropriate terminology

Outcome 2

The learner will:

2 Design a range of analogue electronic circuits by:

2.1 Analysing problems requiring analogue solutions
2.2 Identifying required common input, process and output devices and their symbols
2.3 Combining components and/or sub-systems into complete simple circuit designs
2.4 Describing how a range of familiar and less familiar analogue circuits work, using terminology, including current, voltage, resistance, power and capacitance appropriately
2.5 Carrying out simple calculations involving given formulae

For Outcomes 1 and 2, devices should include resistors, LEDs, diodes, capacitors, transistors, switches and some integrated circuits. Typical circuits should involve a power supply, multiple input devices, processing and more than one output devices.

Outcome 3

The learner will:

3 Describe aspects of the impact of electronics by:

3.1 Describing recycling pathways for electronic devices
3.2 Investigating and reporting on some social, environmental and economic impacts of the increasing use and miniaturisation of electronic devices

Evidence Requirements for the Unit

Assessors should use their professional judgement, subject knowledge and experience, and understanding of their learners, to determine the most appropriate ways to generate evidence and the conditions and contexts in which they are used.

For this Unit, learners will be required to demonstrate technological skills, knowledge and understanding in the context of designing electronic circuits. Evidence of Outcomes may take many forms, including oral or written evidence, or may be demonstrated by carrying out practical tasks which require relevant knowledge and understanding.

Exemplification of assessment is provided in the Unit Assessment Support. Advice and guidance on possible approaches to assessment is provided in the Unit Support Notes.

Assessment standard thresholds

If a candidate successfully meets the requirements of the specified number of Assessment Standards they will be judged to have passed the Unit overall and no further re-assessment will be required.

The specific requirements for this Unit is as follows:

- 8 out of 11 Assessment Standards must be achieved.

It should be noted that there will still be the requirement for candidates to be given the opportunity to meet all Assessment Standards. The above threshold has been put in place to reduce the volume of re-assessment where that is required.

Development of skills for learning, skills for life and skills for work

It is expected that learners will develop broad, generic skills through this Unit. The skills that learners will be expected to improve on and develop through the Unit are based on SQA's Skills Framework: Skills for Learning, Skills for Life and Skills for Work and drawn from the main skills areas listed below. These must be built into the Unit where there are appropriate opportunities.

2 Numeracy

2.3 Information handling

5 Thinking skills

5.2 Understanding
5.3 Applying

Amplification of these is given in SQA's Skills Framework: Skills for Learning, Skills for Life and Skills for Work. The level of these skills should be at the same SCQF level of the Unit and be consistent with the SCQF level descriptor. Further information on building in skills for learning, skills for life and skills for work is given in the Unit Support Notes.

Appendix: Unit support notes

Introduction

These support notes are not mandatory. They provide advice and guidance on approaches to delivering and assessing this Unit. They are intended for teachers and lecturers who are delivering this Unit. They should be read in conjunction with:

- the *Unit Assessment Support packs*
- the *Unit Specification*

Developing skills, knowledge and understanding

Teachers and lecturers are free to select the skills, knowledge, understanding and contexts which are most appropriate for delivery in their centres.

Approaches to learning, teaching and assessment

The Unit is designed to provide flexibility and choice for both the learner and the teacher.

Learning and teaching activities should be designed to stimulate learners' interest, and to develop skills and knowledge to the standard required by the Outcomes and to the level defined by the associated Assessment Standards.

Sequence of delivery

The sequence of delivery and the distribution of time is a matter of professional judgement and is entirely at the discretion of the centre. Two main approaches are suggested, but other possibilities exist.

Delivering Outcomes 1, 2 and 3 sequentially

In this approach, each Outcome is delivered and assessed in turn.

1 Digital circuits. Use of AND, OR, NOT, NAND, XOR and NOR. Combining components into system.
2 Analogue circuits. Common input and output devices. Current, voltage, power, resistance and capacitance. Operational amplifiers. Magnetic effect of current. Carrying out simple calculations using given formulae.
3 The impact of electronics. The social, environmental and economic impact of electronic devices. Recycling pathways of electronic devices.

Delivering Outcome 2 before Outcome 1

Some teachers may prefer to consider analogue circuits first, so that learners understand the various components required for input and output from digital circuits.

Topic approach

There is no requirement to deliver Outcomes 1 and 2 independently. Some teachers may prefer to take a topic-by-topic approach, combining the learning of Outcomes 1 and 2, for example:

1 Resistors and resistance. Power. Magnetic effect of current. Colour code, resistor notation, combining resistors in series and parallel, varying resistance and some uses.
2 Diodes. One-way current, LEDs and some uses.
3 Transistors. NPN and PNP, transistor amplifier, use as an electronic switch.
4 Capacitors and capacitance. Storing electric charge.
5 Integrated circuits. Should include logic gates AND, OR NOT, NAND, XOR, and NOR. Operational amplifier.
6 The systems approach. Should include: input devices, LDR, thermistor and switch; process devices, transistor switch and logic gates; output devices, LED, motor and buzzer.
7 Impact of electronics. An investigation into, for example, the disposal of electronic devices or into the increasing use of electronic devices.

Useful resources

Electronic components can be purchased from a range of commercial suppliers such as Rapid Electronics.

Electronic systems kits, such as the Angus system boards (JJM Electronics), Unilab Alpha modular kits.

Optoelectronics College kits are a useful resource for investigating LEDs and other components.

Suitable texts for reference include:

- *A Practical Approach to System Electronics*, Gregory, Hackett and Vincent-Smith, 1985.
- *Electronics for Dummies*, Dickon Ross
- *Electronics: a Systems Approach*, Dr Neil Storey

The software package Absorb Physics also has some useful notes, diagrams and quizzes on electronics.

There are many useful online videos. For example, on YouTube there are several useful electronic tutorials on ‘expert village’ and ‘make’.

Various Logic Simulators are available, including Logic-Lab from the neuroproductions website.

Approaches to delivering and assessing each Outcome

The learner must demonstrate attainment of **all** of the Outcomes and their associated Assessment Standards. Assessment must be valid, reliable and fit for purpose.

SQA does not specify the methods of assessment to be used; teachers should determine the most appropriate method for their learners. In many cases, evidence (which may be oral or observational) will be gathered during normal classroom activities, rather than through formal assessment instruments.

Centres are expected to maintain a detailed record of evidence, including oral or observational evidence. Evidence in written or presentation format should be retained by the centre for verification.

Authentication of evidence

All evidence should be gathered under supervised conditions.

In order to ensure that the learner's work is their own, the following strategies are recommended:

- personal interviews with learners where teachers can ask additional questions about the completed work
- asking learners to do an oral presentation on their work
- ensuring learners are clear about acknowledging sources
- using checklists to record the authentication activity

Assessment evidence may be produced in a variety of formats including presentations, web pages, digital photographs, digital video, podcasts and blogs, and these can be stored by the learner (or teacher) within a proprietary e-portfolio, or simply by storing them in a secure folder. It should be noted that centres should verify that this evidence is indeed that of the learner and ensure that no credit is given for archive information without further analysis or comment by the student.

Outcome 1
The learner will:

1 Design a range of digital electronic circuits by:

1.1 Analysing problems requiring digital solutions
1.2 Using multi-input combinational logic involving AND, OR, NOT, NAND, XOR and NOR
1.3 Combining components and/or sub-systems into complete circuit designs
1.4 Describing accurately how a range of familiar and less familiar digital circuits work, using appropriate terminology

Notes on delivery of Outcome 1
For Outcomes 1 and 2, devices should include resistors, LEDs, diodes, capacitors, transistors, switches, and some integrated circuits. Typical circuits should involve a power supply, multiple input devices, processing, and more than one output device.

A suitable approach to this Outcome could involve practical activities following teacher introduction, brainstorming on mini whiteboards, circuit simulation and construction on prototype board or commercial systems boards.

Notes on assessment of Outcome 1
Suitable evidence for each Assessment Standard could include oral or written response to questions, photographs of completed circuits and printouts of circuit diagrams and/or simulations.

Outcome 2
The learner will:

2 Design a range of analogue electronic circuits by:

2.1 Analysing problems requiring analogue solutions
2.2 Identifying required common input, process and output devices and their symbols
2.3 Combining components and/or sub-systems into complete simple circuit designs
2.4 Describing how a range of familiar and less familiar analogue circuits work, using terminology, including current, voltage, resistance, power and capacitance appropriately
2.5 Carrying out simple calculations involving given formulae

Notes on delivery of Outcome 2
For Outcomes 1 and 2, devices should include resistors, LEDs, diodes, capacitors, transistors, switches, and some integrated circuits. Typical circuits should involve a power supply, multiple input devices, processing, and more than one output device.

A suitable approach to this Outcome could involve practical activities following teacher introduction, brainstorming on mini whiteboards, circuit simulation and construction on prototype board or commercial systems boards.

Notes on assessment of Outcome 2:
Suitable evidence for each Assessment Standard could include oral or written response to questions, photographs of completed circuits and printouts of circuit diagrams and/or simulations.

Outcome 3
The learner will:

3 Describe aspects of the impact of electronics by:

3.1 Describing recycling pathways for electronic devices
3.2 Investigating and reporting on some social, environmental and economic impacts of the increasing use and miniaturisation of electronic devices

Notes on delivery of Outcome 3
A suitable approach to this Outcome would involve web-based investigations. Groups within the class could investigate different aspects of the use and disposal of electronic devices, and present their findings. Visits to a local industrial site could be arranged through a STEM ambassador.

Notes on assessment of Outcome 3
Suitable evidence for each Assessment Standard could include the learner's contribution to a group presentation.

Developing skills for learning, skills for life and skills for work

Learners are expected to develop broad generic skills as an integral part of their learning experience. The Unit Specification lists the skills for learning, skills for life and skills for work that learners should develop through this Unit. These are based on SQA's Skills Framework: Skills for Learning, Skills for Life and Skills for Work and must be built into the Unit where there are appropriate opportunities. The level of these skills will be appropriate to the level of the Unit.

The table below suggests opportunities to develop these skills during this Unit.

Skill	Opportunity to develop skill
2 Numeracy 2.3 Information handling	Drawing and interpreting system diagrams Drawing and interpreting circuit diagrams
5 Thinking skills 5.2 Understanding	Describing how some simple electronic systems work Describing some social, economic and environmental benefits of electronics Describing, in simple terms, how electronic solutions benefit society
5.3 Applying	Solving electronic problems

The Unit may also provide opportunities to develop or consolidate other skills for life, learning and work, including:

- Reading and writing
- Number processes
- Working with others
- Enterprise and citizenship
- Evaluating

Combining assessment within Units

It may be possible to develop learning/assessment activities which provide evidence that learners have achieved the standards for more than one Outcome within the Unit, thereby reducing the assessment burden on learners. Combining assessment of Outcomes (or parts of Outcomes) in this way is perfectly acceptable, but needs to be carefully managed to ensure that all Assessment Standards and Outcomes for the Unit are covered.

Administrative information

Published: January 2026 (version 3.0)

History of changes to National Unit Specification

Version	Description of change	Date
2.0	Unit code updated.	July 2019
3.0	We have added unit support notes. We have removed 'Practical' from the unit name and changed the unit code. **What you need to do differently** There is no impact on teaching, learning or assessment, however, you must use the new code for entries.	January 2026