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## Electronics and Control

**SCQF:** level 7 (8 SCQF credit points)

**Unit code:** J29G 77

### Unit outline

The general aim of this Unit is to develop a deep understanding of electronic control systems. This Unit explores a range of key concepts and devices related to electronic control systems. Mathematical techniques, and skills in problem solving and evaluating, are developed through simulation and practical projects. Learners will choose and investigate a related aspect of engineering, and apply this in practical situations.

Learners who complete this Unit will be able to:

- 1 Develop complex electronic and programmable control systems
- 2 Investigate an aspect of engineering related to electronic, electrical or control engineering

This Unit is available as a free-standing Unit. The Unit Specification should be read in conjunction with the *Unit Support Notes*, which provide 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 *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 and Control (SCQF level 6) Unit
- ◆ Higher Engineering Science Course
- ◆ Higher Mathematics Course

## **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 Develop complex electronic and programmable control systems by:**

- 1.1 Applying knowledge and understanding of digital and analogue electronics
- 1.2 Applying mathematical techniques
- 1.3 Simulating and/or constructing the systems

### Outcome 2

The learner will:

**2 Investigate an aspect of engineering related to electronic, electrical or control engineering by:**

- 2.1 Researching a relevant engineering topic
- 2.2 Reporting on research and findings

## 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.

Evidence of Outcome 1 may be generated during one or more activities. Systems developed may combine analogue, digital and programmable aspects, although this integration is not a requirement of the Unit.

Evidence of Outcome 2 could be a summary of research findings. The research findings should be into an aspect of electronics and control not covered in the 'Further mandatory information on Course coverage' section of the *Course Assessment Specification* for the Higher or Advanced Higher Engineering Science Courses.

Exemplification of assessment is provided in *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:

- ◆ 4 out of 5 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**

- 2.1 Number processes
- 2.3 Information handling

## **3 Health and wellbeing**

- 3.1 Personal learning

## **4 Employability, enterprise and citizenship**

- 4.2 Information and communication technology (ICT)

## **5 Thinking skills**

- 5.3 Applying
- 5.4 Analysing and evaluating

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 as 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

These support notes 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 specification*
- ◆ the *unit assessment support packs (UASP)*

<b>Calculations</b>	<p>extracting data for use in analysis and calculations</p> <p>manipulating and combining given formulae to obtain answers</p> <p>solving simultaneous equations</p> <p>solving quadratic equations</p> <p>applying trigonometric techniques</p> <p>using integration and differentiation in familiar contexts</p>
<b>Analogue electronics</b>	<p>Kirchhoff's Laws and nodal analysis (with two unknowns) of circuits</p> <p>Designing transistor biasing circuits for a given output load for class A amplifier circuits, using BJT and MOSFET transistor and voltage-divider biasing. Use of DC Load Line and Q-point</p> <p>Schmitt triggers, including use to produce square waves</p> <p>Integrating amplifiers</p> <p>Use of 555 and Wien Bridge oscillators to generate shaped waveforms and clock signals</p>
<b>Digital electronic control systems</b>	<p>Interfacing microcontrollers:</p> <ul style="list-style-type: none"> <li>◆ Connecting digital and analogue input devices (including a conditioning circuit to suit ADC input if required)</li> <li>◆ Connecting digital and analogue output devices (including drive circuits or relay interfaces if required)</li> </ul> <p>Principles and applications of A-D conversion:</p> <ul style="list-style-type: none"> <li>◆ ADC designs in relation to speed, linearity of conversion and resolution, etc</li> <li>◆ Calculation of anticipated binary output for a given analogue input</li> </ul> <p>Principles and applications of D-A conversion</p> <p>Calculation of analogue output for a known binary input based on a summing amplifier</p> <p>Developing programs using an appropriate high-level language to solve control problems involving multiple inputs and outputs, and proportional control</p> <p>Using a range of constructs which include input, output, branching, loops (fixed, continuous, nested), time delays, logic and arithmetical operations, subroutines</p>

<b>Generation and transmission</b>	Basic principles and examples of electrical power generation. Basic principles of electrical power transmission, including: transformers (bus bar and circuit-breaker), advantages of AC, main components of the national grid (step-up and step-down transformers, high voltage transmission, control centre) AC-DC and DC-AC conversion
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# Administrative information

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**Published:** July 2019 (version 3.0)

**Superclass:** XL

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## History of changes to National Unit Specification

Version	Description of change	Authorised by	Date
2.0	Minor changes to wording of Assessment Standards 1.1, 1.2 and 1.3, removal of Assessment Standard 1.4 and replacement of Assessment Standard 2.2.  Evidence requirements for both Outcomes re-worded accordingly.	Qualifications Development Manager	April 2015
2.1	Assessment standard thresholds added	Qualifications Manager	September 2018
2.2	Unit support notes added		
3.0	Unit code updated	Qualifications Manager	July 2019

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Note: readers are advised to check SQA's website: [www.sqa.org.uk](http://www.sqa.org.uk) to ensure they are using the most up-to-date version of the Unit Specification.

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