



National Unit Specification: general information

UNIT Circuit Element Devices (SCQF level 5)

CODE F5H7 11

SUMMARY

This Unit introduces candidates to the three basic electrical circuit element devices of resistance, capacitance and inductance. The main effect of each element, their associated units of measurement and the range of devices available are covered in this Unit. This Unit is suitable for candidates wishing to embark upon a career in electrical and/or electronic engineering. It is also relevant to candidates studying other branches of engineering, science or technology, requiring knowledge of electrical circuit elements. Candidates will be able to apply the skills of device recognition and selection as well as apply fundamental calculations to a wide range of electrical, electronics and related subjects in order to further their knowledge in this area.

This Unit may form part of a National Qualification Group Award or may be offered on a free-standing basis.

OUTCOMES

- 1 Identify resistors and their associated specifications and calculate the resultant resistance for resistors in series and in parallel.
- 2 Identify capacitors and their associated specifications and calculate the resultant capacitance for capacitors in series and in parallel.
- 3 Identify inductors and their associated specifications and calculate the resultant total inductance for inductors in series and in parallel.

Administrative Information

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National Unit Specification: general information (cont)

UNIT Circuit Element Devices (SCQF level 5)

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following, or equivalent:

- ◆ Standard Grade in a Science or Technology subject — General Level

CREDIT VALUE

1 credit at SCQF level 5 (6 SCQF credit points at SCQF level 5*).

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

CORE SKILLS

There is no automatic certification of Core Skills in this Unit.

This Unit provides opportunities for candidates to develop aspects of the following Core Skill:

- ◆ Numeracy (SCQF level 5)

These opportunities are highlighted in the Support Notes of this Unit Specification.

National Unit Specification: statement of standards

UNIT Circuit Element Devices (SCQF level 5)

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit Specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

OUTCOME 1

Identify resistors and their associated specifications and calculate the resultant resistance for resistors in series and in parallel.

Performance Criteria

- (a) State correctly that resistance is a measure of a material's ability to oppose current flow through that material for an applied voltage.
- (b) Identify correctly types of resistor in relation to both physical appearance and symbolic representation.
- (c) Correctly determine fixed resistor parameters for given resistors and specifications.
- (d) Calculate correctly the total resultant resistance for resistors in series and in parallel.

OUTCOME 2

Identify capacitors and their associated specifications and calculate the resultant capacitance for capacitors in series and in parallel.

Performance Criteria

- (a) State correctly that capacitance is a measure of a device's ability to store charge.
- (b) Identify correctly types of capacitors in relation to both physical appearance and symbolic representation.
- (c) Correctly determine fixed capacitor parameters for given capacitors and specifications.
- (d) Calculate correctly the total resultant capacitance for capacitors in series and in parallel.

OUTCOME 3

Identify inductors and their associated specifications and calculate the resultant total inductance for inductors in series and in parallel.

Performance Criteria

- (a) State correctly that inductance is the ability of a circuit to induce an emf in either itself or a neighbouring circuit.
- (b) Correctly differentiate between self-inductance and mutual inductance.
- (c) Identify correctly inductors in relation to both physical appearance and symbolic representation.
- (d) Correctly determine inductor parameters for given inductors and specifications.

National Unit Specification: statement of standards (cont)

UNIT Circuit Element Devices (SCQF level 5)

EVIDENCE REQUIREMENTS FOR THIS UNIT

Evidence is required to demonstrate that candidates have achieved all Outcomes and Performance Criteria.

Performance evidence as well as written and/or recorded oral evidence is required which demonstrates that the candidate has achieved all Outcomes to the standards specified in the Outcome and Performance Criteria.

This evidence should be produced under supervised, controlled conditions at appropriate points throughout the Unit either on an Outcome by Outcome basis or as two separate assessments. All calculations and measurements should be given using the relevant SI units of measurement.

For all Outcomes any appropriate symbol standard is valid. Component specifications to be issued.

The required written and/or recorded oral evidence, generated under closed-book conditions for all Outcomes, is as follows:

- ◆ state correctly that resistance is a measure of a material's ability to oppose current flow through that material for an applied voltage
- ◆ calculate correctly the resultant total resistance for a network containing four resistors in a single series/parallel combination
- ◆ identify correctly that capacitance is a measure of a device's ability to store charge
- ◆ calculate correctly the resultant total capacitance for a network containing four capacitors in a single series/parallel combination
- ◆ state correctly that inductance is the ability of a circuit to induce an emf in either itself or a neighbouring circuit
- ◆ correctly differentiate between self-inductance and mutual inductance

The performance evidence, supplemented by written and/or recorded oral evidence, generated under supervised, controlled conditions for all Outcomes, is as follows:

- ◆ identify correctly, **two** fixed, **two** variable and **one** special resistor in relation to both physical appearance and symbolic representation
- ◆ identify correctly, **one** polarised, **one** non-polarised and **one** variable capacitor in relation to both physical appearance and symbolic representation
- ◆ correctly determine fixed capacitor parameters (value, tolerance, temperature range and voltage rating) for **two** given capacitors and specifications
- ◆ correctly determine fixed resistor parameters (value, tolerance, temperature range and power rating) for **two** given resistors and their associated specifications
- ◆ identify correctly **two different types** of inductor in relation to both physical appearance and symbolic representation
- ◆ correctly determine inductor parameters (value, tolerance, temperature range, current and voltage rating) for **two different** given inductors and specifications

National Unit Specification: support notes

UNIT Circuit Element Devices (SCQF level 5)

This part of the Unit Specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

This is an optional Unit within the National Certificate in Electronic Engineering at SCQF level 5. It may also form part of other National Qualifications Group Awards in Engineering and can also be delivered as a free-standing Unit.

This Unit introduces candidates to the three basic electrical circuit element devices of resistance, capacitance and inductance and is suitable for candidates wishing to gain basic knowledge in this area. This Unit is suitable for candidates wishing to embark upon a career in electrical and/or electronic engineering. It is also suitable for candidates studying other branches of engineering, science or technology, requiring knowledge of electrical circuit elements.

This Unit requires both practical and theoretical activities and it is assumed that elements of delivery will take place in a laboratory environment and that all candidates will work safely in a strictly supervised environment.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

This Unit serves as an introduction to each device and the range of devices available in electrical circuits.

There are many interactive software packages available which are suited to developing the skills, required by candidates, to achieve the Outcomes, to the standards defined in the Performance Criteria. It is recommended that candidates will gain more if such interactive software is used in the teaching and learning approaches for this Unit. All Outcomes lend themselves to internet searches that the candidate can carry out in order to supplement and reinforce learning and teaching material. Candidates may experience a greater sense of achievement if such methods are employed. It is also recommended that candidates have access to a wide range of circuit element devices that are available as individual components as well as being available as part of actual working circuits. All relevant data sheets should be readily available or retrieved as part of an internet search.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

Numeracy skills will be naturally enhanced as the Unit is undertaken. Candidates learn to apply fundamental calculations and the skills of device recognition and selection to electrical, electronics and related subjects. They determine parameters for given specifications and calculate total resultant capacitance or inductance. Formative activities should be contextualised with a focus on the practical interpretation, use and presentation of number and graphics in electronic engineering.

National Unit Specification: support notes (cont)

UNIT Circuit Element Devices (SCQF level 5)

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Opportunities for the use of e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by information and communications technology (ICT), such as e-testing or the use of e-portfolios or e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003)*, *SQA Guidelines on e-assessment for Schools (BD2625, June 2005)*.

All Outcomes require performance evidence as well as written and/or recorded oral evidence. It is recommended that this evidence is produced by two separate assessments. The first assessment comprising of a written test to be completed within one hour under supervised, closed-book, controlled conditions, using an appropriate balance of restricted response and short answer questions and covering Outcome 1, Performance Criteria a and d, Outcome 2, Performance Criteria a and d and Outcome 3, Performance Criteria a and b. The second assessment comprising of a two hour laboratory exercise and/or internet search, carried out under supervised controlled conditions and covering Outcome 1, Performance Criteria b and c, Outcome 2, Performance Criteria b and c and Outcome 3 Performance Criteria c and d.

DISABLED CANDIDATES AND/OR THOSE WITH ADDITIONAL SUPPORT NEEDS

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering whether any reasonable adjustments may be required. Further advice can be found on our website www.sqa.org.uk/assessmentarrangements