National Unit Specification: general information

UNIT Fundamental Electronics (SCQF level 6)

CODE F5DB 12

SUMMARY

This Unit introduces candidates to the principal devices used in electronics and to the principles of their operation, function and applications.

This Unit is suitable for candidates wishing to progress a career in electronic engineering. It is also relevant to candidates studying other branches of engineering, science or technology, requiring an introduction to the principles underlying the operation of electronic devices and to their application in a range of circuits and systems.

Candidates will be able to identify the devices, describe the function and applications of the devices, and also the properties of the materials from which they are constructed. Candidates will also practice circuit construction, assembly and test techniques.

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

OUTCOMES

1 State the relevant properties of materials used in electronic devices.
2 Identify principal electronic devices and use their specification sheets.
3 Describe the construction and applications of principal electronic devices.
4 Implement circuit assembly techniques.
5 Use a range of electronic test equipment.

Administrative Information

Superclass: XL

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National Unit Specification: general information (cont)

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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 – Credit Level
- NQ Unit *Fundamental Electronics* (SCQF level 5)

CREDIT VALUE

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

**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

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

- Problem Solving (SCQF level 5)

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

National Unit Specification: statement of standards

UNIT Fundamental Electronics (SCQF level 6)

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

State the relevant properties of materials used in electronic devices.

Performance Criteria

(a) State correctly the properties of conductors.
(b) State correctly the properties of insulators.
(c) State correctly the properties of semiconductors.

OUTCOME 2

Identify principal electronic devices and use their specification sheets.

Performance Criteria

(a) Identify correctly, both physically and by symbol, passive devices.
(b) Identify correctly, both physically and by symbol, active devices.
(c) Correctly use specification sheets for passive and active devices.

OUTCOME 3

Describe the construction and applications of principal electronic devices.

Performance Criteria

(a) Describe correctly the construction of the principal passive devices.
(b) Describe correctly the applications of passive devices.
(c) Describe correctly the applications of active devices.

OUTCOME 4

Implement circuit assembly techniques.

Performance Criteria

(a) Correctly selects components from a given circuit layout diagram.
(b) Correctly mounts components on a given medium.
(c) Neatly terminates components.

National Unit Specification: statement of standards (cont)

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OUTCOME 5

Use a range of electronic test equipment.

Performance Criteria

(a) Correctly identify and connect power source.
(b) Correctly select and connect appropriate test equipment.
(c) Correctly test the functionality of the constructed circuit.

EVIDENCE REQUIREMENTS FOR THIS UNIT

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

Performance evidence supplemented with an assessor observation checklist 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 will be produced under supervised, controlled conditions at appropriate points throughout the Unit either on an Outcome by Outcome basis or as integrated assessments. All calculations and measurements should be given using the relevant SI units of measurement.

The required evidence, for all Outcomes, is as follows:
For Outcome 1:

- state correctly the properties of conductive materials
- state correctly the properties of insulating materials
- state correctly the properties of semiconductor materials

For Outcome 2:

- identify correctly, both physically and by symbol, passive devices; resistors, inductors, capacitors
- identify correctly, both physically and by symbol, active devices; diodes, transistors, operational amplifiers
- identify two key parameter values for one passive device and one active device from given specifications

For Outcome 3:

- correctly describe, in brief the construction of the principal passive devices; resistors, inductors, capacitors
- correctly describe, in brief one application of each passive device; resistors, inductors, capacitors

- correctly describe, in brief one application of each active device; diodes, transistors, operational amplifiers

For Outcome 4:

- from a given circuit layout diagram comprising the passive and active devices listed in Outcome 2, the candidate correctly selects the components from a wider range of devices
- given a suitable medium, the candidate correctly and neatly mounts and terminates the components

For Outcome 5:

For a given circuit containing passive and active devices.

- correctly identify and connect the power source
- correctly select and connect appropriate test equipment
- correctly test the functionality of the constructed circuit

The Assessment Support Pack for this Unit provides sample assessment material. Centres wishing to develop their own assessments should refer to the Assessment Support Pack to ensure a comparable standard.

National Unit Specification: support notes

UNIT Fundamental Electronics (SCQF level 6)

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 a mandatory Unit within National Certificate in Electronic Engineering, at SCQF level 6, however it can also be taken as a free standing Unit.

This Unit is intended as an introduction to electronic devices, construction techniques and testing.

In addition to introducing the devices' functions and applications, there is a brief description of the construction of the passive devices and a brief introduction to semiconductor principles as used in active devices.

It is not intended that the candidate designs or analyses circuits.

It will be necessary to introduce candidates to a variety of electronic systems and signal conditioning functions to allow them to appreciate the context in which electronic components are used. This would also introduce the concept of 'functionality', eg, 'amplification', 'filtering', 'oscillation', etc.

The candidate also requires practice in the application and operation of test equipment.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

The teaching and learning approaches for this Unit should emphasise practical aspects of electronics such as component recognition, circuit assembly techniques and functional testing of circuits.
The constructional features of the components is also included, and should be taught in such a way as to allow the student to interpret device specifications, and be able to select the appropriate device for a particular application.

The use of test equipment could be demonstrated and practised using pre-constructed circuits covering a range of functions similar to that of the Unit *Fundamental Electronics* (SCQF Level 5), but with more complex circuits or using circuits with multiple stages.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

Elements of the Core Skill of *Problem Solving*, that is, Critical Thinking, Planning and Organising, can be developed as candidates learn how to carry out measurements and tests in electronic circuits. They have to identify and connect a power source before selecting and connecting appropriate test equipment. Methods and techniques to test the functionality of the constructed circuit have to be chosen. Regulations and safety requirements need to be adhered to throughout practical work. Candidates could be given constructive feedback to encourage review and evaluation of their approaches to the process.

National Unit Specification: support notes (cont)

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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).*

The assessment of Outcome 2 PC c) could be combined with the assessment of Outcome 1 and 3 into a single written and/or oral test.
The assessment of Outcome 2 PCs (a) and (b) could be combined with the assessment of Outcome 4 if the circuit for Outcome 4 comprises at least one of each of the six principal devices listed. Otherwise, the assessment of Outcome 2 (a) and (b) would require to be a separate exercise, albeit carried out at the same time as the assessment of Outcome 4.

The evidence for Outcome 2 (a) and (b) could be a checklist recording the correct selection of the actual device and a grid completed by the candidate to record the correct symbol identification.

The evidence for Outcome 4 would be a satisfactorily completed physically constructed circuit.

The evidence for Outcome 5 could be a brief report stating the equipment used, the tests carried out and the result of the tests. This report could be on a pro forma provided to the candidate.

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**