



## National Unit Specification: general information

**UNIT** Practical Electronics (SCQF level 5)

**CODE** F5JJ 11

### SUMMARY

The Unit is intended for candidates with little or no prior knowledge of Analogue or Digital Electronic Circuits. It provides an opportunity for candidates to develop practical construction skills and gain knowledge of electronic components in an informal setting. The emphasis is on the practical building of circuits rather than theory.

Candidates will be able to identify electronic components and be able to construct working analogue and digital electronic circuits using both printed circuit boards and strip board. Candidates will also learn the safe use of basic electronic construction tools.

This Unit is suitable for candidates wishing to embark upon a career in electronic engineering. It is also suitable for candidates studying other branches of engineering, science, computing or technology.

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

### OUTCOMES

- 1 Assemble an analogue electronic circuit.
- 2 Assemble a digital electronic circuit.
- 3 Functionally test and verify analogue and digital electronic circuits.

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#### Administrative Information

**Superclass:** XL

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## **National Unit Specification: general information (cont)**

**UNIT**      Practical Electronics (SCQF level 5)

### **RECOMMENDED ENTRY**

Entry is at the discretion of the centre.

### **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 Skills:

- ◆ Problem Solving (SCQF level 5)

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

## **National Unit Specification: statement of standards**

### **UNIT      Practical Electronics (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**

Assemble an analogue electronic circuit.

##### **Performance Criteria**

- (a) Component selection is correct for given circuit layout diagram.
- (b) Component placement is correct for given circuit layout diagram.
- (c) Component soldering is correct for given circuit layout diagram.

#### **OUTCOME 2**

Assemble a digital electronic circuit.

##### **Performance Criteria**

- (a) Component selection is correct for given circuit layout diagram.
- (b) Component placement is correct for given circuit layout diagram.
- (c) Component soldering is correct for given circuit layout diagram.

#### **OUTCOME 3**

Functionally test and verify analogue and digital electronic circuits.

##### **Performance Criteria**

- (a) Pre power up test is carried out correctly.
- (b) Circuit is connected correctly to power supply.
- (c) Circuit functions are correctly verified in line with given test specification.

## National Unit Specification: statement of standards (cont)

### UNIT Practical Electronics (SCQF level 5)

#### 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 must 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 Outcomes 1 and 2:

- ◆ fully constructed analogue circuit on strip board or PCB artefact
- ◆ fully constructed digital circuit on strip board or PCB artefact

Of the two artefacts required to be retained as evidence, one circuit must be constructed using strip board and one circuit constructed using PCB. Each circuit should have a minimum of 20 soldered joints to include circuit I/O, power supply terminals and test points. Each circuit must comprise of a minimum of eight components including terminal strip and IC sockets. An observation checklist recording component selection, placement and soldering should be retained as evidence.

For Outcome 3:

- ◆ analogue circuit pre-power up test is carried out correctly
- ◆ results of pre-power up test are recorded correctly
- ◆ analogue circuit functions as specified
- ◆ results of functional test are recorded correctly
- ◆ digital circuit pre-power up test is carried out correctly
- ◆ results of pre-power up test are recorded correctly
- ◆ digital circuit functions as specified
- ◆ results of functional test are recorded correctly

Note that hybrid analogue-digital circuits are possible but there must be two circuit boards produced, one circuit constructed on strip board and one circuit on printed circuit board.

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 comparable standard.

## **National Unit Specification: support notes**

### **UNIT          Practical Electronics (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 a restricted core Unit within the National Certificate in Electronic Engineering. It can also be delivered as a free-standing Unit.

It is intended that this Unit should develop a candidate's interest and promote enthusiasm for electronics, the emphasis is therefore the practical construction of both analogue and digital circuits rather than a purely theoretical approach. Although activities are at an introductory level the circuits used however need not be trivial. Examples of electronic devices and systems should be used to illustrate and the relevance of electronic construction using modern examples such as MP3/4 players, e books/readers, mobile phones, DVDS, HDMI TFT and plasma displays, laptop computers, PDAS, internet technology, satellite TV, DAB radios. The social and beneficial aspects of electronics should also be emphasised with references to medical, transport, communications, education, navigation, energy, security, governmental applications and industrial applications as well as entertainment.

#### **GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT**

The Unit delivery is intended to be practical hands on in a laboratory/workshop setting adhering at all times to relevant safety practices. Bought-in or in-house kits could be used for both formative and summative exercises. It is preferable that the assembly process be well supported throughout possibly with the use of paper based worksheets to enable students to work independently and at their own pace.

A selection of practical analogue and digital activities could be made available such as common emitter transistor amplifier, oscillators, filters and op-amp circuits, 555 timer circuits, combinational and sequential logic circuits such as adders, counters, shift registers - each circuit should have a comparable level of constructional difficulty. Candidates would be able to choose from a selection of circuits that interests them to build.

A wide range of standard through hole electronic components could be made available from which a variety of circuits can be constructed using strip board or equivalent and PCB.

For example:

Sockets pins and connectors: SIL, DIL, strip board pins, IDC

Switches: DIL, toggle, micro, slide, reed, rotary

Resistors: Carbon film, LDRs,

Capacitors: Power supply smoothing electrolytic, timing ceramic, tantalum

Inductors: Surge suppressors, coils and transformers

Diodes: Small signal, rectifiers, bridge rectifiers, zener, LEDs

Transistors: Small signal, power, bipolar, FETs, voltage regulators

MSI analogue: Operational amplifiers, PLLs, radio modules

Logic gates: AND, OR, NAND, NOR, XOR, XNOR

## National Unit Specification: support notes (cont)

### UNIT Practical Electronics (SCQF level 5)

Digital MSI devices: Counters, shift registers, MUX, arithmetic, and PLDs

Digital programmable devices: Pic microcontrollers

Display Devices: LEDs, seven segment displays, LCD displays

Output Devices: Lamps, relays, motors, solenoids

Power Sources: NiCd battery, NmHd battery, PV cells, electronic regulated

It is expected that a range of electronic construction tools could be used throughout the Unit such as long nose pliers, snips, wire strippers, soldering iron, tip cleaner, de-soldering tool, lead straightener, small screwdrivers etc.

### OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

The interpretation of information and data from components and layout diagrams and the need to translate worksheet instructions into a working circuit and the subsequent recording of their progress provide candidates with opportunities to develop both Written and Oral *Communication* skills.

The physical implementation of the electronic circuits from written worksheets and a collection of electronic components present candidates with a series of problems to be solved; this provides the candidate with an opportunity to develop their *Problem Solving* skills.

### 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)*.

Worksheets should be used where the candidate records progress during both the construction and testing phases of the assigned analogue and digital circuits.

Layout diagrams should be provided with the worksheets for each construction exercise. Successfully completed circuits should be recorded on the worksheets. All Evidence Requirements to be gathered under supervised workshop/laboratory conditions.

The assessment for this Unit could comprise two Practical Assignments; each assignment could run back to back or extend over the course of the Unit.

Worksheets issued to the students could be used to record the student's progress as well as providing evidence of the final record of successful completion and functional testing of each circuit.

## **National Unit Specification: support notes (cont)**

### **UNIT      Practical Electronics (SCQF level 5)**

#### **Outcome 1 and 2**

- (a) Graphical worksheets can be provided where student selects correct component as specified on the worksheet layout diagram.
- (b) Assembly instructions could be provided that leads the student through the assembly process with reference to a labelled layout diagram.
- (c) Soldered joints should be mechanically and electrically sound with a smooth bright finish; however some slight imperfections should be tolerated in a small quantity of joints if the circuit tests correctly.

#### **Outcome 3**

- (a) Instructions and checklist should be provided indicating the pre-power up tests to be carried out using appropriate test equipment eg DMM, signal generator, scope, logic probe. Continuity tests, checks for shorts, opens, supply and grounds to components could be done using resistance range of DMM. Results of tests being recorded on the pre-power up checklist.
- (b) Instructions can be provided to inform student as to the battery configuration or the setup required if an electronic power supply is used.
- (c) This is basically a functional test; a written specification could be provided to outline the circuit operation to allow the student to make their own judgment on the Outcome of the test.

### **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](http://www.sqa.org.uk/assessmentarrangements)**