National Unit Specification: general information

UNIT Electronic Simulation and Testing (Intermediate 1)

NUMBER D9EN 10

COURSE Applied Practical Electronics (Intermediate 1)

SUMMARY

To introduce and develop skills in:

- computer simulation of electronic systems and circuits
- the use of non-ranging multimeters and d.c. power supplies

OUTCOMES

1 Use a computer to simulate electronic systems.
2 Use a computer to simulate electronic circuits.
3 Set-up and use multimeters to measure resistance, d.c. voltage and d.c. current.
4 Use a low voltage d.c. supply when testing circuits.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained some previous experience in science and/or technology. This may be evidenced by possession of the following:

- Standard Grade Science (including discrete subjects) at 4, 5 and 6
- Standard Grade Technological Studies at 4 and 5
- Electronics (Physics) Intermediate 1

Administrative Information

Superclass: XL

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Version: 01

National Unit Specification: general information (cont)

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CREDIT VALUE
1 credit at Intermediate 1 (6 SCOTCAT Points at SCQF level 4).

*SCOTCAT 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 SCOTCAT 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 or core skills components in this unit.

Additional information about core skills is published in the *Catalogue of Core Skills in National Qualifications* (SQA, 2001).

National Unit Specification: statement of standards

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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 the Scottish Qualifications Authority.

OUTCOME 1
Use a computer to simulate electronic systems.

Performance criteria
a) An electronic system simulation package is accessed correctly.
b) Electronic circuit functions are chosen correctly.
c) Electronic systems are correctly simulated.
d) System functions are adequately tested.

Evidence requirements
Electronic file copy or hard copy of simulated electronic systems which contain input process and outputs in the range.

OUTCOME 2
Use a computer to simulate electronic circuits.

Performance criteria
a) An electronic circuit simulation package is accessed correctly.
b) Electronic and electrical component circuit symbols and representations are chosen correctly.
c) Electronic circuits are correctly simulated.
d) Circuit voltages and currents are correctly tested.

Evidence requirements
Electronic file copy or hard copy of simulated circuits which contain the range of components.

OUTCOME 3
Set-up and use multimeters to measure resistance, d.c. voltage and d.c. current.

Performance criteria
a) A multimeter is set-up to read resistance, current and voltage.
b) The correct range is selected for measuring resistance, current and voltage.
c) The connections to the test circuits are correct.
d) The results of tests are taken and recorded accurately.

Evidence requirements
- completed test results
- observational evidence on the use of a digital non-auto-ranging multimeter.

National Unit Specification: statement of standards (cont)

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OUTCOME 4
Use a low voltage d.c. supply when testing circuits.

Performance criteria
a) The low voltage d.c. power supply is set-up correctly.
b) The low voltage d.c. power supply is connected correctly to the circuits.
c) The low voltage d.c. power supply is used correctly in conjunction with simple test equipment.

Evidence requirements
- completed exercises record
- observational evidence on use of equipment.

National Unit Specification: support notes

UNIT Electronic Simulation and Testing (Intermediate 1)

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.

The purpose of this unit is to enable candidates to build knowledge and practice of computer simulation and testing followed by physical setting up and use of digital non-ranging multimeters. This will be applied to circuits and systems which candidates are intending to build, to specific circuits built as part of this unit or ones built as part of other units.

Candidates attempting this unit will mainly be in post-16 education, although it may also be undertaken by some adult returners and perhaps some candidates in the 14 to 16 curriculum.

In the simulation activities, candidates require little prior experience, but will be expected to produce good organised computer output either electronically or as physical output. In the real testing activities candidate will require some previous experience in building and testing circuits or will require instructions and practice with real circuits before assessment.

As part of a course in the post-16 curriculum, the candidates should be required to act and perform as adults and, accordingly, the tasks set should be challenging to the candidates at the level at which they are working. Apart from developing skills and techniques, this unit should emphasise the need for a disciplined approach to achieving safe and quality work. The use of testing equipment and d.c. power supplies will require discipline in use and more importantly adherence to Health and Safety guidelines and regulations. With regard to the use of computers, candidates operate under an agreed acceptable use policy and this should be applied consistently in accordance with the maturity demanded at this level.

GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

Content

- Computer construction, connection and simulation of electronic systems using input, process and output system blocks or boards.
- Computer construction, connection and simulation of component electronic circuits
- Set-up and use of digital non-ranging multimeter to measure resistance, d.c. current and d.c. voltage and setting-up and use of a low voltage d.c. supply.

This unit is practical in nature and requires the candidate to develop skills in:

- reading and interpreting simple electronic systems and circuits
- drawing/assembling computer based circuits and systems using simulation software taking into account component pin connections and polarity
- applying fault-finding techniques and taking appropriate remedial action in both simulation and actual circuits
- simulating electronic systems and circuits and confirming their operation to specifications
- use of digital multimeters
- use of d.c. voltage supplies
- adherence to Health and Safety procedures, guidelines and regulations
- adhering to acceptable use policy in terms of computer usage

National Unit Specification: support notes (cont)

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The range of electronic components is extensive but could include:

- Sensors such as moisture, light, temperature
- Process devices, such as resistors, capacitors, transistors, ICs
- Output devices such as loudspeakers, buzzers, relays, motors, LEDs, lamps
- Polarity-conscious devices, electrolytic capacitors, diodes, transistors, ICs
- Multi-pin devices, transistors, ICs, relays, variable resistors, thyristors

Outcome 1
Modular input: process and output functions for electronic systems.
Analogue sensors: light; temperature; sound and moisture; digital sensors (push switch, reed and tilt switches); voltage inputs; logic gates; delays; timers; output drivers; and outputs (buzzers, lamps, loudspeakers, and motors).
System functions: desired output for a range of inputs.

Outcome 2
Component circuit symbols: battery; buzzer; capacitor; diode; fuse; 8; 14; or 16 pin integrated circuits; lamp; light dependent resistor; logic gate; loudspeaker; motor; resistor; switch; thermistor; bipolar transistor.
Voltage and current testing: d.c. voltage 0v to 25v, d.c. current 0 mA to 500 mA.

Outcome 3
Digital non-auto-ranging multimeter.
Measuring resistance; 0 Ω to M Ω.
Measuring d.c. voltage; 0v to 25v
Measuring d.c. current; 0 mA to 500 mA.

Outcome 4
Low voltage power supplies; digital non-auto-ranging multimeters.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

There is a progressive learning process in this unit, and this is best achieved in a concentrated manner on each type of activity. This will allow each individual candidate to build expertise in the software and hardware (including multimeters and d.c voltage supplies) being used.

Simulation

In almost all cases candidates will have experience in using computer software and will have built up some level of skills - this will be an advantage. Candidates may also have some experience of the computer packages used and may require only limited guidance. Most simulation software packages have some type of induction or tutorial exercises or programmes and these can be used to build up expertise and confidence.

Testing

The experience of candidates will vary before beginning this part of the unit. Where little or no experience exists, candidates will need to be given practice and instruction in the set-up and use of suitable digital multimeters and d.c. voltage supplies. Where candidates have built up much experience through other units or at standard grade, suitable revision may suffice before attempting this part of the unit and subsequent assessment.

National Unit Specification: support notes (cont)

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General

Support materials (already produced by LTScotland) and commercial or in-house tutorial materials should be used either as whole class teaching, in small groups or on an individual need/support basis. Once candidates have built up enough expertise in the use of the software and hardware, they can either complete the outcomes in a unit approach, where they work through the support exercises and go on to complete the assessment, or alternatively, the unit may be integrated into other units within the course (notably Electronic (Physics) and Practical Electronics). This can be matched as follows: -

System Simulation	Electronics (Physics) Intermediate 1
Circuit Simulation	Practical Electronics Intermediate 1
Testing	Practical Electronics Intermediate 1 Wiring and Assembly Techniques Intermediate 1

After completion of each task, either simulated or testing activities, the candidate's work should be verified as satisfying the operational specifications in the NAB. This should then be recorded on the assessment checklists and should be stored as hard copy and kept as evidence.

Examples of the systems and circuits for the assessment of this unit are given in the NAB. These circuits can be used in certain areas of other units in this course: -

- Electronics (Physics)
- Practical Electronics

This approach could serve any or all of the following three purposes:

- as a rehearsal for part of the course project, during which the candidate is expected to work with a degree of independence
- as a means of re-testing certain performances from other areas of the course
- as a means of reinforcing areas of knowledge and understanding of concepts within other areas of the course.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Whenever possible, the dynamic nature of this course should not be hindered by overburdening assessment of the candidate.

The candidate should be aware that certain performances are being monitored constantly and recorded on an observation checklist. Physical assessment and moderation evidence will be in the form of: -

- hard copy of simulated systems and circuits
- records of testing and measurement results

SPECIAL NEEDS

This unit specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering special alternative outcomes for units. For information on these, please refer to the SQA document *Guidance on Special Assessment Arrangements* (SQA, publication code AA0645).