

## National Unit Specification: general information

**UNIT** Applied Electronics (Advanced Higher)

**NUMBER** D186 13

**COURSE** Technological Studies (Advanced Higher)

### SUMMARY

This unit is designed to enable candidates to develop the level of understanding of analogue and digital electronics introduced at Intermediate 2 and Higher Level.

### OUTCOMES

- 1 Design and construct sequential logic systems to meet given specifications.
- 2 Design and construct sequential logic control systems to perform specified functions.
- 3 Design and construct complex analogue electronic systems, based on operational amplifiers, to meet given specifications
- 4 Investigate Analogue-to-Digital and Digital-to-Analogue converters.

### RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates will normally be expected to have attained Higher Technological Studies at grade A, B or C or to have completed equivalent units.

### CREDIT VALUE

1 credit at Advanced Higher.

### CORE SKILLS

Core Skills for Advanced Higher remain subject to confirmation and details will be available at a later date.

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#### Administrative Information

**Superclass:** XL

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

### **UNIT**                      Applied Electronics (Advanced Higher)

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**

Design and construct sequential logic systems to meet given specifications.

##### **Performance criteria**

- (a) The operation of common sequential logic devices is explained clearly.
- (b) The configuration of sequential logic devices used to perform given sequential logic functions is described correctly.
- (c) Timing diagrams to verify the operation of sequential logic systems are represented correctly.
- (d) A sequential logic system is evaluated correctly to meet a given specification, using computer simulation.
- (e) A sequential logic system is constructed to meet a given specification.

##### **Evidence requirements**

Written and graphical evidence for PCs (a) to (c). Performance evidence for PCs (d) and (e).

#### **OUTCOME 2**

Design and construct sequential logic control systems to perform specified functions.

##### **Performance criteria**

- (a) The function of the main elements of a sequential logic control system is explained clearly.
- (b) The analysis of logic arrays is carried out effectively.
- (c) A sequential control system is evaluated correctly to meet a given specification, using computer simulation.
- (d) A sequential control system is constructed to meet a given specification.

##### **Evidence requirements**

Written and graphical evidence for PCs (a) to (c). Performance evidence for PC (d).

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

**UNIT** Applied Electronics (Advanced Higher)

### **OUTCOME 3**

Design and construct complex analogue electronic systems, based on operational amplifiers, to meet given specifications.

#### **Performance criteria**

- (a) The operation of analogue electronic systems is described correctly.
- (b) Calculations relating to analogue electronic systems are carried out correctly.
- (c) The operation of analogue electronic systems is evaluated correctly to meet given specifications, using computer simulation.
- (d) An analogue electronic system is constructed to meet a given specification.

#### **Evidence requirements**

Written and graphical evidence for PCs (a) and (b). Performance evidence for PCs (c) and (d).

### **OUTCOME 4**

Investigate Analogue-to-Digital and Digital-to-Analogue converters.

#### **Performance criteria**

- (a) Simple A-D calculations based on a set reference voltage are carried out correctly.
- (b) Simple D-A calculations based on a set reference voltage are carried out correctly.
- (c) The function of series and parallel ADCs is explained correctly.

#### **Evidence requirements**

Written and graphical evidence for PCs (a) to (c).

## National Unit Specification: support notes

### UNIT Applied Electronics (Advanced Higher)

This part of the unit specification is offered as guidance. The support notes are not mandatory.

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

A data booklet will be issued by SQA for use in connection with this unit.

### GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

Guidance for each outcome is listed below.

- Outcome 1 Sequential logic devices: S–R bistable, D-type and J–K type bistables.  
Sequential logic systems: registers, counters, frequency dividers, seven-segment displays.  
Timing diagrams: calculations, mark  $T_1 = 0.7(R_1 + R_2)C$ ; space,  $T_2 = 0.7R_2C$ .  
frequency = 
$$\frac{1.44}{(R_1 + 2R_2)C}$$
- Outcome 2 Elements of a sequential control system: clock, binary counter, decimal decoder, logic array, output driver.
- Outcome 3 Operational amplifiers: basic integrator used as a ramp generator.  
Positive feedback and the Schmitt trigger.  
Simple op-amp oscillators and applications (square-wave, saw tooth and sine-wave).  
Mark-to-space ratio.
- Outcome 4 Digital-to-analogue converters (dedicated IC configurations and applications).  
Analogue-to-digital converters (dedicated IC configurations and applications).

Candidates are required to develop an understanding of the function and operation of sequential logic systems and complex analogue systems and to carry out calculations to verify the operation of sequential logic systems. The main areas of study are S-R bistable, D-type bistable, J-K bistable, register, counter, integrator, Schmitt trigger, oscillator, and A-D and D-A converters. In addition, candidates are required to develop practical capabilities in simulating and constructing electronic systems.

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

**UNIT**      Applied Electronics (Advanced Higher)

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

Where appropriate, opportunities should be taken to ensure that the learning and teaching contexts are of an industrial nature and are seen to be relevant by the candidate. Candidates are expected to design and construct systems to meet given specifications. Such systems should be based on sequential logic systems, sequential logic control systems, complex analogue electronic control systems, and A-D and D-A converters.

This unit deals with concepts that are applied in other units and thus offers opportunities for integration of content. In presenting this unit, teachers and lecturers should ensure that there is a balance between teaching and practical activities.

### **GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT**

National Assessment Bank materials have been created specifically to assess knowledge and understanding for each outcome. Assessments can take place either at the completion of an outcome or as an end of unit test. Centres must ensure that tests are conducted under appropriate conditions. Candidates should be allowed to use the Technological Studies Advanced Higher data booklet. Candidates should be issued with clean copies of this booklet for use during tests.

Outcomes 1, 2 and 3 require candidates to simulate, construct and evaluate systems to given specifications. It is the responsibility of the centre to ensure that evidence of candidate performance is recorded in an appropriate way. All evidence of performance must be retained by the centre. The assessment of this unit is subject to moderation by the SQA.

Candidates generate evidence by means of their response to written tests, proficiency in practical activities and systems evaluation.

In order to gain success in the written test for an outcome, each candidate must achieve the cut-off score for that outcome. In order to succeed in practical activities, the candidate must simulate, construct and evaluate a system to meet a given specification. Evidence of performance must be recorded in an appropriate manner. Simulation and construction performance must be observed directly. The candidate's evaluation of a system can be in the form of an oral or written report. Details should be recorded of the particular system(s) dealt with by each candidate.

### **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 alternative outcomes for units. For information on these, please refer to the SQA document *Guidance on Special Assessment and Certification Arrangements for Candidates with Special Needs/Candidates whose First Language is not English (SQA,1998)*.