

National Unit Specification: general information

UNIT	Systems and Control (Advanced Higher)
NUMBER	D187 13
COURSE	Technological Studies (Advanced Higher)

SUMMARY

This unit is designed to enable candidates to develop the level of understanding of principles of control of mechatronic systems introduced at Intermediate 2 and Higher.

OUTCOMES

- 1 Evaluate the operation of microcontrollers.
- 2 Develop a control sequence and use it to control a mechatronic system, by means of a microcontroller.
- 3 Develop a control sequence and use it to provide proportional control of a system.

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.

Administrative Information

Superclass:	VE
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National Unit Specification: statement of standards

UNIT Systems and Control (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

Evaluate the operation of microcontrollers.

Performance Criteria

- (a) The system diagram of a microcontroller is produced correctly.
- (b) The operation of the control process is explained correctly.
- (c) The type and configuration of a microcontroller are selected appropriately to meet a given specification.

Evidence requirements

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

OUTCOME 2

Develop a control sequence and use it to control a mechatronic system, by means of a microcontroller.

Performance Criteria

- (a) The operation and architecture of a microcontroller are described correctly.
- (b) The hardware and software used when developing microcontroller programs in low level assembler code are described correctly.
- (c) A specified control sequence is represented correctly by a flowchart, using symbols from a data booklet.
- (d) A specified control sequence is developed successfully in low level assembler code.
- (e) A control sequence, written in low-level assembler code, is used successfully to control a mechatronic system.

Evidence requirements

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

National Unit Specification: statement of standards (cont)

UNIT Systems and Control (Advanced Higher)

OUTCOME 3

Develop a control sequence and use it to provide proportional control of a system.

Performance Criteria

- (a) A specification for the proportional control of a system is represented correctly by a flowchart.
- (b) A proportional control sequence is developed successfully in low level assembler code, to meet a given specification.
- (c) The function of proportional, integral and derivative (PID) control is explained clearly.
- (d) A proportional control sequence, written in low-level assembler code, is used successfully to control a mechatronic system.

Evidence requirements

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

National Unit Specification: support notes

UNIT Systems and Control (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

Prior work in Applied Electronics (Advanced Higher) is assumed. Guidance for each outcome is listed below.

- Outcome 1 Typical system diagram for microcontroller.
Analogue and digital input and output signals.
Microcontroller types and configurations.
- Outcome 2 Microcontroller architecture and operation.
Hexadecimal counting system: denary – binary – hexadecimal conversions.
Use of flow charts as the basis of a structured, top-down approach to writing a low-level control program.
Writing control programs in a low-level assembly code.
Input transducers: light, temperature, position, moisture.
Output transducers: d.c. motor, stepper motor, solenoid.
Signal-conditioning sub systems: operational amplifier, voltage divider.
- Outcome 3 Use of flow charts as the basis of a structured, top-down approach to writing a proportional control program.
Writing proportional control programs in a low-level assembly code.
Proportional control of a d.c. motor.

Candidates are required to develop an understanding of microcontroller architecture and configurations.

Candidates are also required to develop programs in a low-level assembly code to provide control of a mechatronic system, and also to provide proportional control.

Understanding of electronic systems developed in the Applied Electronics (Advanced Higher) unit should be reinforced through application within this unit.

National Unit Specification: support notes (cont)

UNIT Systems and Control (Advanced Higher)

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

Every opportunity 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 develop control sequences in low-level assembly code to control mechatronic systems.

Candidates will be expected to have prior understanding of computer programming in a high-level language.

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 on 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 2 and 3 require candidates to carry out practical activities. 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 and proficiency in practical activities.

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)*.