

## National Unit Specification: general information

<b>UNIT</b>	Mechatronic Systems: An Introduction (Higher)
<b>NUMBER</b>	D146 12
<b>COURSE</b>	Mechatronics (Higher)

### SUMMARY

The purpose of the unit is to develop an understanding of the integration of electronics, mechanics and computer technology in mechatronic systems.

### OUTCOMES

- 1 Compare and operate a selection of mechatronic systems.
- 2 Compare the variations of controllers used in typical mechatronic systems.
- 3 Specify and select sensor and actuator sub-systems for a mechatronic system.
- 4 Investigate and modify software to control a mechatronic system.

### RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following:

- Standard Grade in Technological Studies or Physics at grade 2 or above
- equivalent National units
- Intermediate 2 Electronic and Electrical Fundamentals or Technological Studies
- Scottish Group Award at Intermediate 2 in an appropriate area.

Note: It is recommended that all candidates should have attained a minimum of Standard Grade Mathematics at Grade 3 or equivalent National units.

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### Administrative Information

<b>Superclass:</b>	XL
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## **National Unit Specification: general information (cont)**

**UNIT**        Mechatronic Systems: An Introduction (Higher)

### **CREDIT VALUE**

1 credit at Higher.

### **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 *Automatic Certification of Core Skills in National Qualifications* (SQA, 1999).

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

### **UNIT        Mechatronic Systems: An Introduction (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**

Compare and operate a selection of mechatronic systems.

##### **Performance criteria**

- (a) The function of a mechatronic system is correctly explained.
- (b) The common elements of a mechatronic system are correctly identified.
- (c) A given task on a mechatronic system is implemented successfully.
- (d) Examples of mechatronic systems are accurately described.

##### **Note on range for the outcome**

Mechatronic system: products, processes.

Common elements: subsystem being controlled, microprocessor based controller, sensors, actuators, interfacing, bus structure, software.

##### **Evidence requirements**

Performance evidence, as well as written and graphical evidence of the candidate's ability to compare and operate a selection of mechatronic systems.

For PC (d) a minimum of two examples should be described which could include the following:

- automatic camera
- automatic washing machine
- pick and place robot
- automatic assembly machine
- automotive engine management system
- computer controlled fitness equipment
- vending machine.

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

### **UNIT        Mechatronic Systems: An Introduction (Higher)**

#### **OUTCOME 2**

Compare the variations of controllers used in typical mechatronic systems.

##### **Performance criteria**

- (a) The flexibility of a range of controllers is correctly identified.
- (b) The architecture of a microprocessor based controller sub-system found in a mechatronic system is correctly described.
- (c) The types of software used by programmable controllers are correctly identified.

##### **Note on range for the outcome**

Controllers: hardwired logic, ASIC, microcontroller, PC, PLC.

Architecture: microprocessor, memory elements, buses, I/O interface.

Software: operating system; high and low level programming.

##### **Evidence requirements**

Written and graphical evidence of the candidate's ability to compare the variation of controllers used in typical mechatronic systems.

#### **OUTCOME 3**

Specify and select sensor and actuator sub-systems for a mechatronic system.

##### **Performance criteria**

- (a) The type of sensor required to process input signals is correctly specified.
- (b) An appropriate sensor for a particular input signal is correctly selected.
- (c) A type of actuator required to deliver output action is correctly specified.
- (d) An appropriate actuator for a particular output action is correctly selected.

##### **Note on range for the outcome**

Input signal: digital, analogue.

Sensor: switch, proximity, temperature, pressure; flow.

Action: rotational, linear.

Actuator: electrical, pneumatic, hydraulic.

##### **Evidence requirements**

Written and graphical evidence of the candidate's ability to specify and select sensor and actuator subsystems for a mechatronic system, as specified in PCs (a) to (d).

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

### **UNIT        Mechatronic Systems: An Introduction (Higher)**

#### **OUTCOME 4**

Investigate and modify software to control a mechatronic system.

##### **Performance criteria**

- (a) Different programming levels are correctly identified.
- (b) Compiled and interpreted high level languages are correctly compared.
- (c) A preprepared software program to control a mechatronic system is correctly used.
- (d) Software code is effectively modified to alter the operation of a mechatronic system.

##### **Note on range for the outcome**

Programming levels: machine code, assembly, high level.

Comparisons: compiler, interpreter, linker, usage of memory, speed of operation.

##### **Evidence requirements**

Written evidence of the candidate's ability to distinguish between programming languages and levels.

Performance evidence of the correct operation of the mechatronic system.

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

### **UNIT      Mechatronic Systems: An Introduction (Higher)**

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

It is recommended that you refer to the SQA Arrangements document for Higher Mechatronics before delivering this unit.

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 develop an understanding of the integration of electronics, mechanics and computer technology in mechatronic systems.

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

This unit should be taught, wherever possible, in a practical or laboratory context. There should be a variety of technologies available, i.e. electro-pneumatic, electro-hydraulic, advanced manufacturing, CNC, robotic, computer/microcontroller/PLC-controlled systems. Candidates should be allowed ample access time to suitably equipped laboratories to enable them to become thoroughly conversant with the equipment.

Suitable mechatronic systems might include: automatic camera; automatic washing machine; automatic assembly machine; automotive engine management system; computer controlled fitness equipment; program-controlled conveyor systems, electro-pneumatic sorters, pick and place robots, vending machine.

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

It is recommended that you refer to the Subject Guide for additional information. The Subject Guide is intended to support the information contained in the Arrangements document. The SQA Arrangements documents contain the standards against which candidates are assessed.

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

Examples of instruments of assessment which could be used are as follows:

- practical assignments
- restricted response questions
- extended response questions
- laboratory investigations
- mini-projects
- case studies.

A candidate-centred resource-based approach to learning should be adopted in which candidates are encouraged to work both individually and co-operatively as team members.

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

### **UNIT        Mechatronic Systems: An Introduction (Higher)**

#### **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).