Higher National Unit Specification

General information for centres

Unit title: Intelligent Instrumentation and Asset Management Systems

Unit code: DX4E 34

Unit purpose: This Unit is designed to enable candidates to gain knowledge and understanding of intelligent instrumentation and asset management systems and apply that knowledge to industrial situations.

On completion of this Unit the candidates should be able to:

1 Explain the operation of Intelligent Instruments and how they are used.
2 Explain the operation of Digital Valve Positioners and how they are used.
3 Explain the use of Asset Management Systems.

Credit points and level: 1 HN Credit at SCQF level 7: (8 SCQF credit points at SCQF level 7*).

**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.*

Recommended prior knowledge and skills: Access to this unit will be at the discretion of the centre and the following recommendations are for guidance only. Candidates should have a basic knowledge of Measurement and Control Engineering. This may be evidenced by the possession of Higher Process Measurement or Higher Process Control or NQ units in Measurement and Control or NC Measurement and Control or NC Multidisciplinary Engineering.

Core Skills: There are opportunities to develop the Core Skills of Written Communication (Writing) and Written Communication (Reading) at SCQF level 5 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Context for delivery: If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

Assessment: The assessment for Outcomes 1, 2 and 3 could be integrated into an end of Unit assessment of no more than three hours consisting of a balance of short answer, restricted response and structured questions. Alternatively, individual written assessments of one hour duration could be used for each Outcome consisting of a balance of short answer, restricted response and structured questions. The assessments should be conducted under closed book controlled supervised conditions. There will also be a short practical assessment for Outcome 1 and Outcome 2 which will last one hour each.

Higher National Unit specification: statement of standards

Unit title: Intelligent Instrumentation and Asset Management Systems

Unit code: DX4E 34

The sections of the Unit stating the Outcomes, knowledge and/or skills, and evidence requirements are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Explain the operation and use of intelligent instruments

Knowledge and/or skills

- Intelligent transmitters
- Merits of intelligent instrumentation over conventional instrumentation
- Communications used in intelligent instrumentation
- Calibrate an intelligent instrument
- Extract information from an intelligent instrument's database

Evidence Requirements

Candidates will require evidence to demonstrate their skills and/or knowledge by showing that they can:

- explain how instrumentation can be enhanced to provide a measure of intelligence
- explain the merits of intelligent instrumentation over conventional instrumentation
- explain the communications used in intelligent instrumentation
- calibrate an intelligent instrument
- extract information from an intelligent instrument's database

Evidence should be generated through assessments undertaken in controlled supervised conditions.

It should be noted that the candidates must achieve all the minimum evidence specified for each Outcome in order to pass the Unit.

A practical assessment with checklist will be used to confirm knowledge and/or skills in the calibration of an intelligent transmitter and extracting information from an intelligent transmitter. The candidate will be given a range of suitable intelligent transmitters and communicator with manuals where appropriate.

The practical assessment for Outcome 1 will last one hour.

Assessment guidelines

Assessments should be conducted under closed book conditions and as such candidates must not be allowed any text books, handouts or notes in the assessment. Questions used to elicit candidate evidence may take the form of short answer or restricted response questions.

The assessment for Outcome 1 could be integrated with Outcomes 2 and 3 into an end of Unit assessment of no more than three hours consisting of a balance of short answer, restricted response and structured questions. Alternatively, an individual assessment of one hour duration could be used for Outcome 1.

There will also be a short practical assessment.

Outcome 2

Explain the operation of Digital Valve Positioners and how they are used

Knowledge and/or skills

- Intelligent valve positioners
- Software used with digital valve positioners
- Software to diagnose valve performance

Evidence Requirements

Candidates will require evidence to demonstrate their skills and/ or knowledge by showing that they can:

- explain the use of a microcontroller within a valve positioner
- explain the use of software with digital valve positioners
- use software to control a digital valve positioner and check valve performance

Evidence should be generated through assessments undertaken in controlled supervised conditions.

It should be noted that the candidates must achieve all the minimum evidence specified for each Outcome in order to pass the Unit.

A practical assessment with checklist will be used to confirm knowledge and/or skills of using software to control a digital valve positioner and to check valve performance.

The candidate will be given a suitable valve positioner, valve and software to perform the checks.

The practical assessment for Outcome 2 will last one hour.

Assessment guidelines

Assessments should be conducted under closed book conditions and as such candidates must not be allowed any text books, handouts or notes in the written assessment. Questions used to elicit candidate evidence may take the form of short answer or restricted response questions.

The assessment for Outcome 2 could be integrated with Outcomes 1 and 3 into an end of Unit assessment of no more than three hours consisting of a balance of short answer, restricted response and structured questions. Alternatively, an individual assessment of one hour duration could be used for Outcome 2.

There will also be a short practical assessment.

Outcome 3

Explain the use of Asset Management Systems

Knowledge and/or skills

- The functions of an Asset Management System
- The communications used with an Asset Management System
- The use of Asset Management Systems

Evidence Requirements

Evidence for the knowledge and/ or skills in this Outcome will be provided on a sample basis. The evidence may be provided in response to specific questions.

Each candidate will need to demonstrate that they can answer questions based on a sample of the items shown above.

In any assessment two out of the three knowledge and/or skills should be sampled.

In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample of two out of the three knowledge and/ or skills is required each time the Outcome is assessed.

Candidates must provide a satisfactory response to both items.

Where sampling takes place, a candidate's response can be judged to be satisfactory where evidence provided is sufficient to meet the requirements for each item by showing that the candidate is able to:

- explain the functions of an Asset Management System
- explain the communications used with an Asset Management System
- explain the use of Asset Management Systems

Evidence should be generated through assessments undertaken in controlled supervised conditions.

Assessment guidelines

Assessments should be conducted under closed book conditions and as such candidates must not be allowed any text books, handouts or notes in the assessment. Questions used to elicit candidate evidence may take the form of short answer or restricted response questions.

Higher National Unit specification: statement of standards (cont)

Unit title: Intelligent Instrumentation and Asset Management Systems

The assessment for Outcome 3 could be integrated with Outcomes 1 and 2 into an end of Unit assessment of no more than three hours consisting of a balance of short answer, restricted response and structured questions. Alternatively, an individual assessment of one hour duration could be used for Outcome 3.

Administrative Information

Unit code: DX4E 34

Unit title: Intelligent Instrumentation and Asset Management Systems

Superclass category: VE

Original date of publication: July 2006

Version: 01

History of Changes:

Version	Description of change	Date

Source: SQA

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Higher National Unit specification: support notes

Unit title: Intelligent Instrumentation and Asset Management Systems

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 Unit has been written in order to allow candidates to develop knowledge, understanding and skills in the following areas:

1 The operation of Intelligent Instruments and how they are used.
2 The operation of Digital Valve Positioners and how they are used.
3 The use of Asset Management Systems.

The Unit is at SCQF level 7 and the Unit has been developed as part of the new HNC/D Measurement and Control Engineering award. However this does not preclude the use of this Unit in other awards where award designers feel it is appropriate.

In designing this Unit, the writer has identified the range of topics that they would expect to be covered by lecturers. The writer has also given recommendations as to how much time should be spent on each Outcome. This is done to help lecturers to decide what depth of treatment should be given to the topics attached to each Outcome.

A list of topics for each Outcome is given below.

Outcome 1

Explain the operation of Intelligent Instruments and how they are used. (15 hours)

- The use of microcontrollers to provide a measure of intelligence in a transmitter.
- The merits of using intelligent instrumentation when compared to conventional instrumentation.
- The use of communications protocols (HART, etc.) with intelligent transmitters.
- Methods of communication with an intelligent transmitter (hand held communicator, PC).
- Multi drop systems and their advantages.
- Bench calibration of intelligent transmitters.
- Extraction of information from intelligent transmitters.
- Use of information extracted from intelligent transmitters.

Outcome 2

Explain the operation of Digital Valve Positioners and how they are used. (15 hours)

- The use of microcontrollers to provide a measure of intelligence in a Digital Valve Positioner.
- The merits of using a Digital Valve Positioner compared with a conventional valve positioner.
- The use of analytical software (eg Fieldview) and modem link to diagnose valve performance
  — tight shut off

- — sticking stem
- — valve stroke
- — valve characteristic
- — fault finding etc

- ♦ Checking a valve using a Digital Valve Positioner and suitable software.

Outcome 3

Explain the use of Asset Management Systems (AMS). (10 hours)

- ♦ Use of AMS to communicate with and manage devices on a plant
  - — configure/re-range and perform diagnostic checks
  - — check device status
  - — perform loop tests and self tests
  - — track device history
  - — link associated device notes
  - — automate maintenance documentation
  - — streamline device calibration management
  - — exchange device information
  - — exchange calibration information with a supported self-documenting calibrator
- ♦ AMS in single work station systems
  - — work station — desktop/laptop
  - — network connections — Ethernet including TCP/IP loopback adaptor
  - — software — use if AMS application/file server/plantserver and database
- ♦ AMS in distributed systems
  - — deployment of multiple AMS workstations with access to a common AMS database
  - — communication interfaces — HART modem/multiplexers/host system networks/communicators and self documenting calibrator
- ♦ Use of OPC

The assessment for Outcomes 1, 2 and 3 could be integrated into an end of Unit assessment of no more than three hours consisting of a balance of short answer, restricted response and structured questions. Alternatively, individual written assessments of one hour duration could be used for each Outcome consisting of a balance of short answer, restricted response and structured questions. The assessments should be conducted under closed book controlled supervised conditions. There will also be a short practical assessment for Outcome 1 and Outcome 2 which will last one hour each.

There may be opportunities to gather core skills in this Unit, although there is no automatic certification of core skills or core skill components.

There are opportunities to develop the Core Skills of Written Communication (Writing) and Written Communication (Reading) at SCQF level 5.

Higher National Unit specification: support notes (cont)

Unit title: Intelligent Instrumentation and Asset Management Systems

Guidance on the delivery and assessment of this Unit

It is intended that this Unit is presented in the context of process control used in industrial situations.

This Unit has been written to incorporate sufficient time to allow the lecturer to teach, in a student centred way, the operation and use of a number of intelligent instrumentation devices to include transmitters and valve positioners.

The content of the three Outcomes means that they could be delivered in any order.

The knowledge and skills of the first two Outcomes will be supported by practical activities.

Details on approaches to assessment are given under Evidence requirements and Assessment guidelines under each Outcome in the Higher National Unit specification: Statement of Standards section. It is recommended that these sections be read carefully before proceeding with assessment of candidates.

Opportunities for developing Core Skills

There are opportunities to develop the Core Skills of Written Communication (Writing), Written Communication (Reading) and Problem Solving (Critical Thinking) at SCQF level 5 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Open learning

This Unit could be delivered by distance learning, which may incorporate some degree of on-line support. With regard to assessment, planning would be required of the Centre concerned to ensure the sufficiency and authenticity of candidate evidence. Arrangements would be required to be put in place to ensure that written assessments were conducted under controlled, supervised conditions. Arrangements would need to be made to ensure that the candidate could perform practical work. This could involve the candidate attending the Centre or utilising video conferencing. Alternatively, special arrangements could be made for the candidate to demonstrate the practical work to a designated, responsible person local to the candidate.

For information on open learning, please refer to *SQA guide assessment and quality assurance of open and distance learning (A1030, Feb 2001).*

Higher National Unit specification: support notes (cont)

Unit title: Intelligent Instrumentation and Asset Management Systems

Candidates with disabilities and/or additional support needs

The additional support 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 Alternative Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs,* which is available on SQA's website: **www.sqa.org.uk**.

General information for candidates

Unit title: Intelligent Instrumentation and Asset Management Systems

This Unit has been designed to provide you with knowledge and skills that will enable you to understand and implement Intelligent Instrumentation and Asset Management within Measurement and Control. This Unit may be assessed using one written assessment covering all three Outcomes or by three separate assessments covering one Outcome each. All assessment will be undertaken under supervised conditions. You will not be allowed to take notes, handouts, textbooks, etc into the assessment.

In Outcome 1 you will learn about intelligent transmitters and how to calibrate them and extract information from them. There will be a short practical assessment for this Outcome.

In Outcome 2 you will learn about digital valve positioners and how to use them to check on the performance of a valve. There will be a short practical assessment for this Outcome.

In Outcome 3 you will learn about Asset Management Systems and how they can be used to record information relating to items of equipment on the plant.