SQA Advanced Unit Specification

General information for centres

Unit title: Engineering Communication

Unit code: HV42 47

Unit purpose: This Unit has been designed to develop candidates' knowledge, understanding and skills in communicating and analysing engineering information. Candidates will have opportunities to develop their skills in sketching engineering components and system layouts using appropriate standards and conventions. They will also develop knowledge, understanding and skills in simulating engineering systems, and sub-systems, using appropriate software. Candidates will also be provided with opportunities to develop oral communication skills by presenting orally information on the analysis and evaluation of an engineering system or subsystems.

On completion of the Unit the candidate should be able to:

1 Sketch engineering components and system layouts using appropriate standards and conventions.
2 Simulate, using appropriate software, engineering systems or sub-systems.
3 Communicate the analysis and evaluation of an engineering system or subsystem.

Credit points and level: 1 SQA 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 National 1 to Doctorates.*

Recommended prior knowledge and skills: It is recommended that candidates have a knowledge and understanding of Graphical Communication and Information Technology. This may be evidenced by possession of a Higher in Graphical Communication and the Using Information Technology Core Skills at SCQF level 5 level or an equivalent level of experience.

Core Skills: There may be opportunities to gather evidence towards the following listed Core Skill components in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Oral Communication	SCQF level 6
Using Graphical Information	SCQF level 6
Using Information Technology	SCQF level 6
Critical Thinking	SCQF level 6

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 strategy for this Unit is as follows:

Outcome 1 should be assessed by candidates producing a range of sketches to cover system layout (including block diagrams) and component level representations. Candidates should do the assignment in their own time. Centres may wish to combine aspects of the assessment of this Outcome with the assessment of Outcome 1 in the Principles of Engineering Systems unit.

Outcome 2 should be assessed by candidates undertaking an assignment on a mechanical and an electrical engineering system in which they display the simulation processes and produce a portfolio which contains software produced drawings of the systems, an analysis of results, an evaluation of the simulation processes and suggestions for further work. Candidates should complete the assignment in their own time.

Outcome 3 should be assessed by candidates undertaking a 10 minute presentation on the analysis and evaluation of an engineering system or subsystems. Candidates will be expected to participate in a 5 minute Question and Answer session on their presentation.

To consolidate knowledge and understanding of engineering systems approaches it is recommended that centres use the same engineering systems, or sub-systems, as are used in the Principles of Engineering Systems and Engineering Measurement and System Monitoring units.

SQA Advanced Unit specification: statement of standards

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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

Sketch engineering components and system layouts using appropriate standards and conventions

Knowledge and/or skills

- Two/three dimensional standards / conventions
- Dimensioning
- Accuracy of representation
- Proportion
- Legibility
- Clarity of sketch and supporting textual information

Evidence Requirements

All knowledge and/or skills items in this Outcome should be assessed.

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by sketching engineering component and system layouts (including block diagrams) using appropriate symbols and component level drawings. Sketches must conform to:

- appropriate standards and conventions
- contain appropriate dimensions
- be accurately sketched
- be in proportion
- be legible in term of the sketch and supporting text

Evidence should be generated by candidates producing a range of sketches to cover block diagram, system layout and component level representations.

The assessment should be undertaken as an assignment in which candidates present their various sketches. Candidates should do the assignment in their own time.

Centres should make every reasonable effort to ensure the assignment solution is the candidate's own work. Where copying or plagiarism is suspected candidates may be interviewed to check their knowledge and understanding of the subject matter. A checklist should be used to record oral evidence of the candidate's knowledge and understanding.

Assessment guidelines

Centres may wish to combine aspects of the assessment of this Outcome with the assessment of Outcome 1 in the Principles of Engineering Systems unit.

Outcome 2

Simulate, using appropriate software, engineering systems or sub-systems

Knowledge and/or skills

- Layout capture
- Software libraries of engineering symbols
- Simulation set up
- Analysis of result
- Evaluation of simulation process

Evidence Requirements

All knowledge and/or skills items in this Outcome should be assessed.

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by using software to draw an engineering system and simulate its response to appropriate stimuli.

Evidence should be generated by candidates undertaking an assignment on both a mechanical and an electrical engineering system in which they display the simulation processes and produce a portfolio which contains software produced drawings of the systems, an analysis of results and an evaluation of the simulation process. Candidates should do the assignment in their own time.

Centres should make every reasonable effort to ensure the assignment solution is the candidate's own work. Where copying or plagiarism is suspected candidates may be interviewed to check their knowledge and understanding of the subject matter. A checklist should be used to record oral evidence of the candidate's knowledge and understanding.

Assessment guidelines

To consolidate knowledge and understanding of engineering systems approaches it is recommended that centres use the same engineering systems, or sub-systems, as are used in the Principles of Engineering Systems unit.

Outcome 3

Communicate the analysis and evaluation of an engineering system or subsystem

Knowledge and/or skills

- Structure of presentation
- Clarity of communicating technical information
- Use of visual aids
- Timing
- Response to questions

Evidence Requirements

All knowledge and/or skills items in this Outcome should be assessed.

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by a presentation of information on an engineering system or sub-system which satisfies the following:

- contains technically correct information
- is well structured (i.e. contains a clear introduction, middle and conclusions)
- communicated to the whole audience
- is of an appropriate pitch and pace
- consistent engagement with the audience (e.g. proper eye contact as appropriate)
- is within allocated time
- appropriate use is made of visual aids
- clear and correct answers are given to questions

A candidate presentation should last ten minutes and should be followed by five minutes for questions. The minimum audience size must be four.

Assessment guidelines

The presentation may be based on the engineering systems studied in Outcome 2 or any other system studied as part of the SQA Advanced Certificate in Engineering Systems.

Centres should develop a checklist to record candidate performance in the oral presentation.

Candidates should be encouraged to make use of laptop and digital projection equipment**.** Where a candidate is unable to give a presentation under the specification given above centres may wish to use alternative approaches (eg candidate is filmed giving a presentation: answers to questions given via e-mail, or a video of the system with voice over etc).

Administrative Information

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Unit title: Engineering Communication

Superclass category: VF

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SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of SQA Advanced Qualifications.

FURTHER INFORMATION: Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our Centre Feedback Form.

SQA Advanced Unit specification: support notes

Unit title: Engineering Communication

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 1-credit, SCQF Level 7 Unit has been written as one of the four mandatory Principles/Technology units within the SQA Advanced Certificate in Engineering award. The other three mandatory units are *Principles of Engineering Systems*, *Engineering Measurement and Systems Monitoring* and *Mathematics for Engineering 1: Mechanical and Manufacturing*. The *Principles of Engineering Systems* unit is a 2 credit SQA Advanced unit while the *Engineering Measurement and Systems Monitoring* and *Mathematics for Engineering 1: Mechanical and Manufacturing* units are both 1 credit SQA Advanced units. All three units are at SCQF level 7. It is important that all four units are seen as providing an integrated programme of study covering a systems approach to the analysis of engineering processes and systems. As such every opportunity should be sought to combine the delivery and assessment of the four units.

The emphasis in the four units should be on allowing candidates to develop knowledge and understanding of basic ideas and concepts involved in engineering systems rather than on any mathematical treatment of systems. Equal emphasis should be given to mechanical and electrical concepts, ideas and quantities.

In designing this Unit, the unit writers have identified the range of topics expected to be covered by lecturers. The writers have also given recommendations as to how much time should be spent on each Outcome. This has been done to help lecturers decide what depth of treatment should be given to the topics attached to each of the Outcomes. Whilst it is not mandatory for centres to use this list of topics it is strongly recommended that they do so to ensure continuity of teaching and learning, and because the assessment exemplar pack for this Unit is based on the knowledge and/or skills and list of topics in each of the Outcomes.

A list of topics is given below. Lecturers are advised to study this list of topics in conjunction with the assessment exemplar pack so that they can get a clear indication of the standard of achievement expected of candidates in this Unit.

1 Sketch engineering components and system layouts using appropriate standards and conventions (9 hours)

Candidates should be provided with plenty of opportunities to develop their sketching skills by sketching a wide range of mechanical and electrical/electronic components and layouts. Candidates should produce both two and three dimensional sketches using appropriate standards/conventions. Sketches should be dimensioned wherever appropriate. Candidates should be encouraged to develop sketches that are neat, clean and accurately represent the engineering component or system layout; are properly proportioned and contain clear and legible supporting textual information.

2 Simulate, using appropriate software, engineering systems or sub-systems (21 hours)

In this Outcome candidates should be encouraged to use modern simulation software to firstly produce accurate drawings of both electrical/electronic and mechanical systems and sub-systems. Candidates should be encouraged to make extensive use of software libraries of engineering symbols. Having developed appropriate system drawings, the software should be used to simulate system (and sub-system) operation and performance. Candidates should analyse results of the simulation process with a view to commenting on system performance. They should also evaluate how effective the simulation process has been in predicting system and sub-system performance.

3 Communicate the analysis and evaluation of an engineering system or subsystem (10 hours)

In this Outcome candidates should be provided with opportunities to develop their oral communication skills by presenting information on the analysis and evaluation of an engineering system or subsystems. Such a system, or sub-system, could be the one in Outcome 2 or an alternative system. Centres may select the system for candidates or allow candidates to decide what system they wish to do their presentation on. Many candidates come with little knowledge and skills in giving an effective presentation. They are also likely to be nervous and lack confidence in doing a presentation in-front of their peers and lecturer. Centres should ensure that candidates are provided with support in preparing for their presentation including information and advice on the following:

- how to structure the presentation
- presenting technical information in a clear and accurate way
- making effective use of visual aids
- how to time the presentation
- how to respond to questions

Guidance on the delivery and assessment of this Unit

It is important that emphasis throughout the Unit is placed on a systems approach to engineering processes and systems with equal weighting being given to mechanical and electrical engineering concepts, ideas and quantities.

In Outcome 1 it is important that candidates are provided with opportunities to sketch a wide range of both mechanical and electrical/electronic components and system layouts so that they gain an awareness of different engineering component and system representations and have an opportunity to develop their sketching skills.

With regard to Outcome 2 centres may be able to obtain good quality electrical/electronic and mechanical engineering simulation software at reasonable cost. Some types of software may be obtained via the Internet.

Industrial visits may prove useful in allowing candidates to observe the types (and standards) of drawing used in engineering companies. Candidates may also be provided with opportunities to view industrial standard engineering stimulation software in use.

Candidates will have opportunities to develop their Using Graphical Information Core skills through the sketching and simulation exercises undertaken in Outcomes 1 and 2. Information Technology Core Skills may be enhanced during the engineering systems simulation studies in Outcome 2. Critical thinking skills are also likely to be developed in the simulation exercises in Outcome 2 especially in analysing the results of simulations, evaluating the effectiveness of the simulation process and in making recommendations for further work. Oral Communication Core Skills may be developed during the preparation for and in giving the oral presentation in Outcome 3.

Details on the approaches to assessment are given under Evidence requirements and Assessment guidelines under each Outcome in the SQA Advanced Unit specification: statement of standards section. It is recommended that these sections are read carefully before proceeding with assessment of candidates. It is strongly recommended that candidates are provided with clear details about assessment at the beginning of the Unit (eg dates for submission of portfolios, and date and time of oral presentation).

Opportunities for developing Core Skills

There may be opportunities to gather evidence towards the following listed Core Skill components in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Oral Communication	SCQF level 6
Using Graphical Information	SCQF level 6
Using Information Technology	SCQF level 6
Critical Thinking	SCQF level 6

Open learning

The delivery of this Unit will normally require high levels of tutor/candidate interaction and support in all three outcomes which may limit opportunities for delivery of the Unit by distance learning.

Where open learning is considered due regard to assessment planning would be required by the centre concerned to ensure the sufficiency and authenticity of candidate evidence.

For information on normal open learning arrangements, please refer to the SQA guide *Assessment and Quality Assurance of Open and Distance Learning (SQA 2000).*

Equality and inclusion

This unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

General information for candidates

Unit title: Engineering Communication

An essential part of being a good technician or engineer is an ability to communicate technical information to others effectively. In this Unit you will study various ways of communicating engineering information. For example, in Outcome 1 you will be encouraged to develop your skills in sketching engineering components and system layouts. Sketching often represents the first important stage in developing full engineering drawings. In Outcome 2 you will use a modern software package to produce a detailed drawing of an engineering system. You will then use this drawing to simulate the operation of the system with a view to analysing the performance of the system. In Outcome 3 you will be encouraged to develop the very important skills of communicating technical information orally by giving a presentation and answering questions based on the presentation.

During the delivery of the Unit your lecturer will provide you with plenty of 'hands-on' opportunities to develop your sketching, Information Technology and oral presentation skills. You may feel nervous about giving an oral presentation in front of your fellow students and lecturer. If you do, please speak to your lecturer who may be able to provide you with extra support to give your presentation or look at alternative ways of doing the presentation (eg filming you do the presentation without an audience, taking questions by e-mail etc.).

Formal assessment in the Unit will consist of you producing a portfolio of engineering sketches, preparing a portfolio of information based around the use of the engineering simulation software and giving a 10 minute technical presentation followed by a 5 minute question and answer session.