

SQA Advanced Graded Unit specification: general information

This Graded Unit has been validated as part of the SQA Advanced Certificate in Engineering Systems award. Centres are required to develop the assessment instrument in accordance with this validated specification. Centres wishing to use another type of Graded Unit or assessment instrument are required to submit proposals detailing the justification for change for validation.

Graded Unit title: Engineering Systems: Graded Unit 1

Graded Unit code: HV3C 47

Type of Graded Unit: Examination

Assessment Instrument: Examination

Publication date: August 2018

Source: Scottish Qualifications Authority

Version: 02

Unit purpose

This Graded Unit is designed to provide evidence that the candidate has achieved the following principal aims of the SQA Advanced Certificate in Engineering Systems:

- ◆ Develop knowledge, understanding and skills in an engineering systems approach to the study of Engineering
- ◆ Develop candidates' ability to apply analysis and synthesis skills to the solution of engineering problems
- ◆ Develop learning and transferable skills (including Core Skills)

Recommended prior knowledge and skills

It is recommended that the candidate should have completed or be in the process of completing the following Units relating to these specific aims prior to undertaking this Graded Unit:

- ◆ Communication: Practical Skills
- ◆ Principles of Engineering Systems
- ◆ Engineering Communication
- ◆ Engineering Measurement and System Monitoring
- ◆ Mathematics for Engineering 1: Mechanical and Manufacturing

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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.*

Core Skills

There are no Core Skills embedded in this Graded Unit specification.

Assessment

This examination-based Graded Unit is Engineering. It will consist of a written examination of three hours.

An exemplar Instrument of Assessment and marking guidelines have been produced to indicate the national standard of achievement required at SCQF Level 7.

SQA Advanced Graded Unit specification: Instructions for designing the assessment task and assessing candidates

Graded Unit title: Engineering Systems: Graded Unit 1

Conditions of Assessment

The assessment is based on an examination lasting three hours.

The examination should be unseen and the assessment should be conducted in controlled and invigilated conditions.

At all times, the security, integrity and confidentiality of examinations must be ensured.

Reasonable assistance is the term used by SQA to describe the difference between providing candidates with some direction to generate the required evidence for assessment and providing too much support, which would compromise the integrity of the assessment. Reasonable assistance is part of all learning and teaching processes. In relation to the assessment of Advanced Certificate/Diploma examination-based Graded Units, assessors may provide advice and guidance on examination technique and clarification on the meaning of command words which may appear within an examination paper, prior to the formal examination.

The examination paper should comprise of a case study of an engineering system or systems. The Examination paper should have the following two sections. Section A, comprising of between eight and 12 short answer and restricted response questions based on the case study and covering topics across all Units in the Principles/Technology section of the SQA Advanced Certificate in Engineering award. Candidates should answer all questions in this section and be able to score a maximum of 50%. The paper should also have a Section B comprising of three 25 mark questions. Each of the three questions, while covering topics within the Units in the Principles/Technology section of the SQA Advanced Certificate in Engineering award, should have a particular engineering bias (eg electrical/electronics, mechanical/manufacture/fabrication or mechatronics) to reflect to some degree the candidates specialisation in the optional units. Candidates should be able to score a maximum of 50% from Section B.

Candidates should be given a copy of the case study only 14 days before they sit the examination.

The examination should be conducted under closed-book, supervised conditions.

The examination paper should be unseen prior to the assessment event which should be conducted under controlled and invigilated condition.

Instructions for designing the assessment task

The examination should be designed to assess the candidate's critical knowledge and understanding of the topics relating to the specific aims which this Graded Unit is designed to cover. The questions and corresponding marks should be designed in accordance with the ranges indicated in the table that follows. However, the overall total mark for the examination is 100.

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Topic	Level of knowledge/ understanding	Weighting/ mark allocation
Apply mathematical techniques in the context of engineering.	Apply algebraic and vector techniques to solve problems commonly found in engineering.	5%
Block diagram representation of engineering systems.	Represent mechanical, electrical and electromechanical systems in block diagram format.	10%
Sketch engineering component and system layout.	Accurate neat and annotated sketches of component and layout.	10%
Description and comparison of engineering quantities.	Explain a minimum of four electrical and four mechanical quantities given in the Principles of Engineering Systems Unit and compare and contrast these mechanical and electrical quantities.	15%
Energy calculations and audit.	Perform energy calculations involving at least two mechanical and two electrical energy/power forms. Undertake an energy audit of a system where appropriate.	15%
Material properties.	Identify key properties of materials used in engineering system and suggest possible alternatives.	10%
Engineering system responses and corrective actions.	Draw typical engineering responses and recommended corrective action for a system operating out with its normal range.	15%
Sensor/Transducer operation and applications.	Describe the operation and application of at least one electrical and one mechanical transducer.	20%

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The examination will be marked out of 100. Assessors will aggregate the marks achieved by the candidate to arrive at an overall mark for the examination. Assessors will then assign a grade to the candidate for this Graded Unit based on the following grade boundaries:

- ◆ A = 70%–100%
- ◆ B = 60%–69%
- ◆ C = 50%–59%

These grade boundaries are fixed and should **not** be amended.

Remediation is not allowed in Examination-based Graded Unit assessments.

Any candidate who has failed their Advanced Certificate/Diploma examination-based Graded Unit or wishes to upgrade their award must be given a re-assessment opportunity, or in exceptional circumstances, two re-assessment opportunities. This must be done by using a substantially different examination.

The final grading given must reflect the quality of the candidate's evidence at the time of the completion of the graded unit. Candidates must be awarded the highest grade achieved, whether through first sitting or through any re-assessment.

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.

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Guidance to Centres

Centres are encouraged to study this Engineering Systems: Graded Unit 1 specification and the associated Assessment Exemplar paper carefully before embarking on the writing of any SQA Advanced Certificate in Engineering Systems Examination paper.

The main purpose of the Engineering Systems: Graded Unit 1 specification is to assess the candidate's ability to solve problems based on the Engineering Units specified under the Recommended Prior Knowledge and Skills section in this Graded Unit specification. Centres should make every attempt to ensure that questions are set within a realistic industrial context. Centres should also make every reasonable effort to integrate the knowledge and understanding learnt in one subject area to another area(s) so that candidates' ability to transfer knowledge and understanding from one subject area to another can also be assessed. Experience shows that candidates often have great difficulty in transferring knowledge, understanding and skills from one subject area to solve problems in another area of study. Candidates tend to compartmentalise knowledge, understanding and skills into subject areas with considerable reluctance to transfer across subject boundaries. It is important, however, in Engineering that candidates can apply knowledge, understanding and skills from different subject areas to the solution of complex problems.

As well as having a three hour examination, the Unit includes a notional study time of 37 hours to allow candidates to practise solving problems which should include the transfer of knowledge, understanding and skills across the subject boundaries. Centres should use a range of formative assessments to support such skills development.

Centres are also strongly recommended not to limit opportunities for the transferability of knowledge, understanding and skills within the SQA Advanced Certificate in Engineering Systems to the Engineering Systems: Graded Unit 1 only, but to seek opportunities for the consolidation of these critical skills throughout the whole SQA Advanced Certificate award.

History of changes to Unit

Version	Description of change	Date
02	Update of Conditions of Assessment	06/08/18

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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](#).

General information for candidates

Graded Unit Title: Engineering Systems: Graded Unit 1

The main purpose of the Engineering Systems: Graded Unit 1 is to assess your ability to solve problems based on the Engineering Units specified below and given in the context of a 3 hour closed book, supervised, examination with questions based on an engineering systems case study given out 14 days before the examination:

- ◆ Communication: Practical Skills
- ◆ Principles of Engineering Systems
- ◆ Engineering Communication
- ◆ Engineering Measurement and System Monitoring
- ◆ Mathematics for Engineering 1: Mechanical and Manufacturing

The Examination paper will comprise of two sections. Section A consists of compulsory questions covering the above units and accounts for 50% of the total marks for the paper and section B comprising of three 25 mark questions which are more specialised in nature but only two questions should be attempted in this section and accounts for the other 50% of the total marks.

The grades available for this Graded Unit are as follows:

- ◆ A = 70%–100%
- ◆ B = 60%–69%
- ◆ C = 50%–59%

Throughout the study of this unit you are advised to carry out the following activities:

- ◆ develop a study and revision plan with suitable and realistic time-scales.
- ◆ create a calendar of important dates such as the examination date, date of mock examinations, etc.
- ◆ ensure that all relevant material is readily available and logically organised.
- ◆ study in suitable blocks of time according to a realistic and meaningful schedule as detailed in your study and revision plan.
- ◆ make revision notes of all important procedures and information.
- ◆ develop personal revision material based upon the supplied material and revision notes ensuring that it is related to specific examination topics.
- ◆ develop strategies for remembering important material.
- ◆ practice examination questions relevant to each topic.
- ◆ develop a feedback plan about attempted practice examination questions and general progress, with assessors, if practicable.
- ◆ search for other suitable material if relevant to the topics to be examined.

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A typical list of techniques that you should employ when sitting an examination is given below:

- ◆ Read all examination instructions carefully and follow these instructions. Examination instructions will generally include information such as the time allocated for the examination, a list of allowable items such as calculators, a list of items that are usually not allowable such as text books; reference will be made regarding material supplied such as diagrams and worksheets, etc. It will also include information on how to complete the examination answer stationery provided, such as the information required on the examination answer stationery front cover, eg candidate name, candidate number, questions attempted, etc. It may also give guidance with regard to how to lay out the answers, eg start each question on a new page, show all working, etc.
- ◆ Read each question carefully, going through the whole examination paper from start to finish before attempting any question. Try to ensure that each question is interpreted correctly. In addition, try to decide if all parts of the question can be attempted and not just part of the question.
- ◆ Where there is choice, eg attempt any two questions from three, select the questions that appear easiest to answer. This decision can only be made if the entire paper is read before attempting to answer any questions.
- ◆ Plan each answer in advance. Most centres provide blank paper for such purposes. As a general 'rule of thumb' each examination question requires approximately 20% planning, 70% writing and 10% checking. 'Writing' can be interpreted as writing essays, carrying out calculations, drawing diagrams and tables, etc.
- ◆ Plan the order in which to attempt each question. Do not just start at Question 1 unless that is the most straightforward question to answer. The order in which questions are answered can affect a candidate's confidence and ultimately affect the marks achieved. Every candidate is different but most candidates should attempt the questions that appear the easiest to answer first, leaving the most complex questions to the end.
- ◆ Allocate time appropriately. This is not an exact science but for a three hour examination, with two sections each worth 50% of the available marks, allow 30 minutes to read the paper and plan answers, 1 hour to answer each section and the final 30 minutes for checking each answer.