

SQA Advanced Graded Unit Specification

General information for centres

This graded unit has been validated as part of the SQA Advanced Certificate/Diploma in Electrical Engineering. 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: Electrical Engineering: Graded Unit 1

Graded Unit Code: HV4C 47

Type of Graded Unit: Examination

Assessment Instrument: Closed-book examination

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.*

Purpose: This graded unit is designed to provide evidence that the candidate has achieved the following principal aims of the SQA Advanced Certificate/Diploma awards in Electrical Engineering: Graded Unit 1.

- ◆ develop knowledge, understanding and skills in a range of core electrical principles, electrical power systems, electrical machine principles and electrical safety at SQA Advanced level (these studies in core electrical principles and technologies are underpinned by a mandatory unit in Mathematics)
- ◆ develop candidates' ability to apply analysis and synthesis skills to the solution of electrical engineering problems
- ◆ develop learning and transferable skills (including core skills)
- ◆ develop a range of communication knowledge and skills relevant to the needs of electrical incorporated engineers

SQA Advanced Graded Unit Specification

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:

- ◆ Single Phase AC Circuits
- ◆ Three-Phase Systems
- ◆ Electricity Power Systems
- ◆ Electrical Machine Principles
- ◆ Mathematics for Engineering 1: Electronics and Electrical
- ◆ Communication: Practical Skills

Core skills: There are no core skills embedded in this graded unit specification.

Assessment: This examination-based graded unit is Electrical Engineering: Graded Unit 1. It will consist of a written examination of three hours duration.

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

Administrative information

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Graded Unit Title: Electrical Engineering: Graded Unit 1

Date of publication: November 2017

Source: SQA

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SQA Advanced Graded Unit Specification: instructions for designing the assessment task and assessing candidates

Graded Unit Title: Electrical Engineering: Graded Unit 1

Conditions of assessment

The assessment is based on a closed-book examination lasting three hours. The examination will consist of six 25-mark questions with candidates being allowed to answer any four out of the six questions. Candidates will be allowed access to standard formulae and appropriate data sheets where required.

If a candidate does not achieve a pass or if a candidate wishes to retake the graded unit examination, this must be based on a significantly different examination from that given originally. A candidate's grade will be based on his/her achievement on the new event using a significantly different examination.

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.

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.

Topic	Level of knowledge/ understanding	Weighting/ Mark Allocation
Apply single phase AC theory to solve electrical engineering problems	Solve single-phase AC circuits using complex notation	10%
Apply three-phase electrical theory to solve electrical engineering problems	Describe the production and characteristics of a three-phase supply Analyse the response of balanced and unbalanced star and delta connected loads supplied by symmetrical three-phase supplies. Analyse power in three-phase loads.	20%

SQA Advanced Graded Unit Specification

Topic	Level of knowledge/ understanding	Weighting/ Mark Allocation
Utilising single and/or three-phase AC theory to solve electricity power systems problems	Demonstrate knowledge of electricity supply systems. Analyse distribution systems Analyse faults on a three-phase system Explain methods of improving power system efficiency.	20%
Analysing electrical machine operations and characteristics making use of single and three AC theory where appropriate to support the analysis	Examine electromagnetic field concepts and circuits Analyse the construction, operation and characteristics of DC motors, single-phase motors, three-phase induction motors, transformers and synchronous generators and motors	30%
Apply the manipulation and solution of equations and complex number theory to the solution of electrical engineering problems	Algebraic techniques to manipulate expressions and solve equations commonly found in engineering Carry out operations involving complex numbers Analyse trigonometric functions and their graphs.	10%
Use communication skills to interpret and respond to written electrical engineering questions	Respond to written information on a complex vocational issue Produce written information in a prescribed format on a complex vocational issue	10%

The structure of each questions should normally conform to the following marking structure:

Knowledge and understanding	5 marks
Applications	10 marks
Analysis and evaluation	10 marks

SQA Advanced Graded Unit Specification

The structure of the paper should comply with the following format:

- ◆ two questions majoring on electrical machine principles
- ◆ two questions majoring on single-phase circuits and three-phase systems
- ◆ two questions majoring on electricity power systems with some three-phase principles included

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%

Guidance to centres

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

The main purpose of the Electrical Engineering: Graded Unit 1 specification is to assess the candidate's ability to solve problems which involve the integration of some knowledge and skills from one of the four main electrical engineering areas of electrical machine principles, electricity power systems and single phase AC circuits and three-phase systems. In addition to this, limited opportunities are also provided to assess some Communications and Mathematical skills although such assessment of these skills should be set within the context of Electrical Engineering.

Integration involves the ability to apply knowledge, understanding and skills obtained in one subject area to another area. For example, it is recognised that a good level of knowledge and skills in electrical principles and mathematics is essential for the delivery and assessment of other electrical engineering subjects such as electricity power systems and electrical machines. The Electrical Engineering: Graded Unit 1 examination should avoid the duplication of the areas being assessed in the individual units.

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 the electrical engineering industry, to apply knowledge, understanding and skills from different subject areas to solve complex problems in other areas and the acquisition of these skills is of vital importance. The Electrical Engineering: Graded Unit 1 provides opportunities to develop these critical transferability and problem solving skills.

As well as having a three-hour examination, the unit includes a notional study time of 37 hours to allow candidates to practice solving problems which involve the transfer of knowledge, understanding and skills across the subject boundaries. Centres should use a range of formative assessment to support such skills developments.

SQA Advanced Graded Unit Specification

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

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.