SQA Advanced Graded Unit specification

General information for centres

This Graded Unit has been validated as part of the SQA Advanced Certificate and SQA Advanced Diploma in Mechanical 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: Mechanical Engineering: Graded Unit 1

Graded Unit Code: HT7G 47

Type of Graded Unit: Examination

Assessment Instrument: 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 in Mechanical Engineering.

- develop knowledge, understanding and skills in a range of core principles and technologies by undertaking Units in engineering drawing, quality systems, engineering principles, materials selection, statics and strength of materials, dynamics, thermofluids and pneumatics and hydraulics

- develop candidates' ability to apply analysis and synthesis skills to the solution of mechanical 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:

- Mathematics for Engineering 1: Mechanical and Manufacturing
- Quality Management: An Introduction
- Engineering Principles
- Materials Selection
- Statics and Strength of Materials

- Dynamics
- Thermofluids
- Pneumatics and Hydraulics

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

Assessment: This examination based Graded Unit is Mechanical 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.

Administrative Information

Graded Unit Code: HT7G 47

Graded Unit Title: Mechanical Engineering: Graded Unit 1

Date of publication: August 2018

Version: 02

History of Changes:

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

Source: SQA

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

Graded Unit Title: Mechanical Engineering: Graded Unit 1

Conditions of Assessment

The assessment is based on an examination paper consisting of a Section A covering topics in the Units: Mathematics for Engineering 1: Mechanical and Manufacturing, Quality Management: An Introduction, Engineering Principles and Materials Selection. Candidates should answer all questions in this Section and be able to score a maximum of 40%. The Paper should also have a Section B which should cover topics in the Units: Statics and Strength of Materials, Dynamics, Thermofluids and Pneumatics and Hydraulics. Section B should comprise five questions worth 20% each and candidates should be able to select any three from five questions allowing them to score a maximum of 60%.

The examination should be conducted under closed-book, supervised conditions but with candidates being allowed access to standard formulae and appropriate data sheets where required.

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

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.

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.

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	Approximate weighting/ mark allocation
Apply mathematical techniques in the context of Mechanical and Manufacturing Engineering	Apply algebraic and vector techniques to solve problems commonly found in Engineering.	**6%**
Identify key principles behind Quality Control and Quality Assurance Apply Quality Improvement Techniques	Explain the fundamental principles of Quality Assurance and Quality Control Analyse and select appropriate methods of control for a given process	**6%**
Demonstrate a fundamental understanding of statics and strength of materials, dynamics and thermofluids	Demonstrate a knowledge and understanding of the following: ♦ Statics and Strength of Materials ♦ Dynamics ♦ Thermofluids	**18%**
Demonstrate a knowledge of the basic properties of materials Select suitable materials for a range of products	Identify basic properties for a range of materials Select suitable materials for a range of products	**10%**
Demonstrate an ability to solve problems relating to static equilibrium and compressive, tensile and shear loadings on materials	Solve problems relating to static equilibrium Solve problems relating to compressive, tensile and shear loading on materials	**18%**
Demonstrate an ability to solve problems involving linear and/or angular motion and problems relating to impulse, conservation of momentum work, energy or power	Solve problems relating to linear and angular motion Solve problems relating to impulse, conservation of momentum, work, energy and power	**18%**
Demonstrate an ability to evaluate properties and energy transfers of perfect gases and vapours Solve problems involving the application of energy, continuity and momentum principles to non-compressible steady flow processes	Evaluate properties and change of state for perfect gases and vapours Evaluate energy transfers for perfect gases and vapours Apply energy, continuity and momentum principles to non-compressible steady flow processes	**18%**
Demonstrate an ability to describe the operation and maintenance of a compressed air or hydraulic system	Describe the operation and maintenance requirements of compressed air and hydraulic systems	**6%**

Questions in Section A of the Examination Paper should normally comprise a number of short answer, restricted response and calculation based questions.

In Section B the structure of each question should normally conform to the following marking structure:

Knowledge and understanding	4 marks
Applications	8 marks
Analysis and evaluation	8 marks

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%

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.

Guidance to Centres

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

The main purpose of the Mechanical Engineering: Graded Unit 1 specification is to assess the candidate's ability to solve problems based on the Mechanical Engineering Units specified under the Recommended Prior Knowledge and Skills 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 Mechanical Engineering to the Mechanical 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 in Mechanical Engineering.