



Higher National Examination-based Graded Unit Specification

General Information

This Graded Unit has been validated as part of the HNC Aircraft Engineering. Centres are required to develop the assessment instrument in accordance with this validated specification.

Graded Unit title: Aircraft Engineering: Graded Unit 1
(SCQF level 7)

Graded Unit code: H9AV 34

Type of Examination: Closed-book

Publication date: June 2015

Source: Scottish Qualifications Authority

Version: 01

Graded Unit purpose

This Graded Unit is designed to provide evidence that the learner has achieved the following principal aims of the HNC in Aircraft Engineering:

- ◆ Enhance learners' employment prospects
- ◆ Support learners' career development and Continued Professional Development
- ◆ Enable progression within the SCQF (Scottish Credit and Qualifications Framework)
- ◆ Provide learners with progression to the HND in Aircraft Engineering
- ◆ Develop learners knowledge, understanding and practical skills consistent with progression to, and within, careers in aircraft/aeronautical engineering
- ◆ Develop learners ability to interpret and apply analysis skills to the solution of aircraft/aeronautical engineering related problems
- ◆ Provide learners with a qualification that meets the educational requirements that contributes to the attainment of professional registration with the UK Engineering Council as an Engineering Technician

Credit points and level

1 Higher National Unit credit at SCQF level 7: (8 SCQF credit points at SCQF level 7)

Higher National Examination-based Graded Unit Specification: General Information (cont)

Recommended entry to the Graded Unit

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

Engineering Mathematics 2

Physics for Aviation

Aerodynamics and Flight Mechanics 1

Aircraft Structures and Materials

Aircraft Propulsion Systems: Introduction

Core Skills

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

Assessment Support Pack

The Assessment Support Pack for this Unit provides assessment and marking guidelines that exemplify the national standard for achievement. It is a valid, reliable and practicable instrument of assessment. Centres wishing to develop their own assessments should refer to the Assessment Support Pack to ensure a comparable standard. Assessment Support Packs are available on SQA's secure website.

Equality and inclusion

This Graded Unit 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 SQA's website:
www.sqa.org.uk/assessmentarrangements

Higher National Examination-based Graded Unit Specification: Designing the examination and assessing learners

Graded Unit title: Aircraft Engineering: Graded Unit
(SCQF level 7)

Assessment

This Graded Unit will be assessed by the use of a *closed-book examination* developed by centres. The examination should provide the learner with the opportunity to produce evidence that demonstrates she/he has met the aims of this Graded Unit.

The assessment is an examination that comprises two question papers each of one and a half hours duration.

The examination should be designed to assess the learner's critical knowledge and understanding of the topics relating to the specific aims which this Graded Unit is designed to cover.

The examination will be marked out of **100**. Only whole marks should be used.

The questions and corresponding marks should be designed in accordance with the key topics (ie the critical knowledge and skills to be covered in the examination), level of demand (eg description, explanation, analysis, application) and relative mark allocation for each key topic outlined in the table below.

Key topics	Level of demand	% mark allocation for each key topic
Engineering Mathematics 2	Learners should be able to answer 20 questions which assess their ability to: <ul style="list-style-type: none">◆ solve trigonometric and hyperbolic function problems.◆ use differentiation techniques to solve Engineering problems.◆ use integration techniques to solve Engineering problems.	20%

Higher National Examination-based Graded Unit Specification: Designing the examination and assessing learners (cont)

Graded Unit title: Aircraft Engineering: Graded Unit
(SCQF level 7)

Key topics	Level of demand	% mark allocation for each key topic
Physics for Aviation	<p>Learners should be able to answer 20 questions which assess their ability to:</p> <ul style="list-style-type: none"> ◆ explain and apply the concepts, theories and principles used to solve engineering solid mechanics problems. ◆ explain and apply the concepts, theories and principles used to solve engineering thermofluid problems. ◆ explain and apply the concepts, theories and principles used to solve wave motion and vibration problems. 	20%
Aerodynamics and Flight Mechanics 1	<p>Learners should be able to answer one question from a choice of two sampled from the following topics:</p> <ul style="list-style-type: none"> ◆ The physics of the atmosphere and how it affects flight ◆ Aircraft layout and configuration ◆ Aircraft lift and drag ◆ High-lift devices and their impact on aircraft performance 	20%
Aircraft Structures and Materials	<p>Learners should be able to answer one question from a choice of two sampled from the following topics:</p> <ul style="list-style-type: none"> ◆ The characteristics and properties of materials used in aircraft construction ◆ The general concepts and classification of aircraft structures designed to meet airworthiness requirements ◆ The construction methods of major components of an aircraft structure 	20%

Higher National Examination-based Graded Unit Specification: Designing the examination and assessing learners (cont)

Graded Unit title: Aircraft Engineering: Graded Unit
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Key topics	Level of demand	% mark allocation for each key topic
Aircraft Propulsion Systems: Introduction	<p>Learners should be able to answer one question from a choice of two sampled from the following topics:</p> <ul style="list-style-type: none"> ◆ The principles of operation of aircraft gas turbine and piston engines ◆ The principles of thrust production for aircraft gas turbine and piston engines used on fixed and rotary wing aircraft ◆ The layout and operation of fuel and lubrication systems used in both piston and gas turbine engines ◆ The layout and operation of starting and ignition systems used in both piston and gas turbine engines 	20%
Total marks for Examination		100

Conditions of assessment

The examination is closed-book.

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

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

The assessment is based on two examination papers (Paper 1 and Paper 2) each of one and a half hours duration. Paper 1 will consist of 30 multiple-choice questions and 10 restricted response questions from the Units *Engineering Mathematics 2 and Physics for Aviation*. In Paper 2, learners will choose to answer three questions, one from each section (*Aerodynamics and Flight Mechanics 1, Aircraft Structures and Materials and Aircraft Propulsion Systems: Introduction*). Each section is worth 20 marks.

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

Higher National Examination-based Graded Unit Specification: Designing the examination and assessing learners (cont)

Graded Unit title: Aircraft Engineering: Graded Unit
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The grade given will reflect the learner's achievement on the first assessment event. A learner may wish to retake the Group Award Graded Unit but this should be based on a significantly different examination.

If a learner does not achieve a pass or if a learner wishes to retake the Graded Unit examination, this must be based on a significantly different examination from that given originally. A learner's grade will be based on his/her achievement on the new event using a significantly different examination. The examination papers should follow the guidelines on security, integrity and confidentiality outlined above.

Higher National Examination-based Graded Unit Specification: Designing the examination and assessing learners (cont)

Assessing and grading learners

Learners who meet the minimum Evidence Requirements will have their achievement graded as an A, B or C. The Grade Related Criteria to be used to judge learner performance for this Graded Unit is specified in the following table.

Grade Related Criteria	
Grade A	Grade C
<p>Is a seamless, coherent piece of work or exam script which consistently:</p> <ul style="list-style-type: none"> ◆ interprets and understands the question in a way that demonstrates insight and clear understanding of issues and relationships ◆ demonstrates a comprehensive analysis and evaluation of relevant information ◆ offers logically structured and coherently expressed responses, demonstrating consistent use of correct terminology ◆ is clear and well-structured throughout, with language and terminology used of a consistently high standard in terms of level, accuracy, and technical content ◆ consolidates and integrates required knowledge and skills, linking concepts and ideas, and relating answers explicitly to the question ◆ provides evidence of possible alternative approaches and arguments as well as understanding of different interpretations ◆ convincingly argues and shows links between discussions and conclusions, demonstrating comprehensive knowledge and understanding as well as analysis and evaluation skills 	<p>Is a co-ordinated piece of work or exam script which:</p> <ul style="list-style-type: none"> ◆ interprets and understands the question in a way that enables the learner to meet the basic criteria required ◆ demonstrates limited analysis, evaluation, and explanation of the question and other relevant information ◆ offers uneven responses that convey limited understanding although some relevant points are made ◆ is satisfactorily structured, with language and terminology used adequate, although not always consistent, in terms of level, accuracy, and technical content ◆ consolidates and integrates knowledge and skills but may lack continuity and consistency and fail to show clear links to concepts and ideas ◆ is likely to show only one approach and limited understanding of different interpretations ◆ argues and justifies conclusions in an acceptable way but these conclusions may lack reasoned understanding, may not link well to discussions, and may show limited knowledge

Higher National Examination-based Graded Unit Specification: Designing the examination and assessing learners (cont)

Graded Unit title: Aircraft Engineering: Graded Unit
(SCQF level 7)

The marks achieved by the learner in the examination should be aggregated to arrive at an overall mark for the examination. Assessors will then assign an overall grade to the learner 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.

If a learner does not achieve a pass or wishes to upgrade, then this must be done using a substantially different examination. In these circumstances, the highest grade achieved should be awarded.

More information on reasonable assistance, remediation and re-assessment may be found in the SQA publication *Guidance for the Implementation of Graded Units in Higher National Certificates and Diplomas* (SQA, 2008, Publication code: CA4405).



Higher National Examination-based Graded Unit Support Notes

Graded Unit title: Aircraft Engineering: Graded Unit
(SCQF level 7)

Guidance on approaches to delivery and assessment of this Graded Unit

Centres are encouraged to study this *Aircraft Engineering: Graded Unit 1* specification and the associated specimen paper carefully before embarking on the writing of any HNC Aircraft Engineering examination papers.

The main purpose of the *Aircraft Engineering: Graded Unit 1* specification is to assess the learner's ability to solve problems which involve the integration of some knowledge and skills from one of the five main Aircraft Engineering areas of *Engineering Mathematics, Physics for Aviation, Aerodynamics and Flight Mechanics, Aircraft Structures and Materials* and *Aircraft Propulsion Systems*. In addition to this, limited opportunities are also provided to assess some Communications skills although such assessment of these skills should be set within the context of Aircraft Engineering.

The *Aircraft Engineering: Graded Unit 1* examination should avoid duplicating areas that are assessment in individual Units so far as is possible.

In addition to the two one and a half hour examinations, the Unit requires a notional study time of 37 hours to allow learners to revise key themes and to allow lecturers to prepare learners for the examinations. Centres should use a range of formative assessment to support the preparation of the learner for examinations.

Opportunities for developing Core and other essential skills

Learners will have opportunities to develop the Core Skills of *Problem Solving* (Critical Thinking, Reviewing and Evaluating) and *Numeracy* at SCQF level 5 in this Unit, although there is no automatic certification of Core Skills or Core Skills components. Both *Problem Solving* and *Numeracy* could be achieved in Paper 1 by solving mathematical calculations (for example, algebraic relationships, standard derivatives and standard integrals), while the questions posed in Paper 2 could ask learners to use basic engineering equations to calculate lift, drag and thrust and interpret engineering data contained in ISA tables, lift curves, drag curves, the Structural Repair Manual (SRM) and/or Thrust Available/Thrust Required curves.

History of changes to Graded Unit

Version	Description of change	Date

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General information for learners

Graded Unit title: Aircraft Engineering: Graded Unit (SCQF level 7)

This section will help you decide whether this is the Unit for you by explaining what the Unit is about, what you should know or be able to do before you start, what you will need to do during the Unit and opportunities for further learning and employment.

The Graded Unit is designed to provide evidence that you have developed a knowledge and understanding of the core aerospace subjects of Engineering Mathematics, Physics, Aerodynamics and Flight Mechanics, Aircraft Structures and Materials and Aircraft Propulsion Systems.

The Unit is primarily intended for learners who are interested in aircraft engineering and is offered as a core Unit in the HNC and HND Aircraft Engineering Group Awards.

The assessment is a closed-book examination undertaken at the end of the HNC Aircraft Engineering course. It is based on two examination papers each of one and a half hours duration. The Units covered in the examination are: *Engineering Mathematics 2, Physics for Aviation, Aerodynamics and Flight Mechanics 1, Aircraft Structures and Materials and Aircraft Propulsion Systems: Introduction*.

Learners who meet the minimum Evidence Requirements will have their achievement graded as an A, B or C. The grade boundaries are:

A	=	70%–100%
B	=	60%–69%
C	=	50%–59%

You will have opportunities to develop the Core Skills of *Problem Solving* (Critical Thinking, Reviewing and Evaluating) and *Numeracy* at SCQF level 5 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

This Unit may be of particular interest if you wish to pursue a career in aircraft engineering as an aerodynamicist or design engineer or if you intend to look to undertake an HND in Aircraft Engineering or an Aircraft Engineering degree course.