



Higher National Unit Specification

General information for centres

Unit title: Electronic Fundamentals for Aviation

Unit code: DR07 34

Unit purpose: This Unit is designed to give candidates an introduction to a variety of electronic devices and circuits that form the key building blocks of many systems on board an aircraft. This Unit is of particular value to candidates whom are looking to develop an understanding of an aircraft's avionic systems. This Unit also provides some of the underpinning knowledge components for the EASA Part 66 Module 4, Chapter 4.1.

This Unit is designed to provide candidates with professional knowledge and skills for the specific occupational area of aircraft engineering. It is logical to deliver this Unit sequentially by Outcome, with a mixture of assignments, exercises and case studies. Having access to relevant publications is recommended and course work and assignment reports must be the work of individuals.

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

- 1 Describe simple diode principles and common applications.
- 2 Describe simple BJT (By Junction Transfer) principles and common applications.
- 3 Describe operational amplifier principles and common applications.
- 4 Describe combinational logic circuits and simple applications.

Credit points and level: 1 HN 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 Access 1 to Doctorates.*

Recommended prior knowledge and skills: Access to this Unit will be at the discretion of the centre. The Unit has no mandatory prerequisites, however it is recommended that the candidates have completed Unit DR06 34 *Electrical Fundamentals for Aviation* or a suitable group of Electrical Principles units from an appropriate NQ award before commencing this Unit.

Core Skills: There may be opportunities in this Unit to gather evidence towards the Core Skills of *Numeracy* at Higher level, *Problem Solving* at Higher level and *IT* at Intermediate 2 level, although there is no automatic certification of Core Skills or Core Skills components.

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.

General information for centres (cont)

Unit title: Electronic Fundamentals for Aviation

Assessment: Candidates can be assessed on an Outcome by Outcome basis or by a single assessment combining Outcomes 1, 2 and 4 and a case study/investigation covering Outcome 3. The assessments could be composed of an appropriate balance of short answer, restricted response and structured questions. Assessment should be carried out under supervised, controlled conditions.

The assessment instruments used should follow the general guidelines offered by the Scottish Qualification Authority (SQA) assessment model and an integrative approach to assessment is encouraged.

Accurate records should be made of the assessment instruments used showing how evidence is generated for each assessment/examination, giving marking schemes and/or checklists, etc. Records of candidates' achievements should be kept. These records will be available for external verification.

Higher National Unit specification: statement of standards

Unit title: Electronic Fundamentals for Aviation

Unit code: DR07 34

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.

Acceptable performance in this Unit will be the satisfactory achievement of the standard set out in this part of the specification. All sections of the statement of standards are mandatory and cannot be altered without reference to the SQA.

Candidates should not know in advance the items on which they will be assessed and different questions should be used on each assessment occasion.

Assessments for this Unit are to be carried out under closed-book supervised conditions and any notes made by the candidates during assessment should be handed in at the end.

Outcome 1

Describe simple diode principles and common applications

Knowledge and/or Skills

- ◆ P-N Diode symbols and operation
- ◆ Diode characteristics
- ◆ P-N Diode junction operation
- ◆ Diode applications including rectifiers (full and half wave), clippers and clamping circuits
- ◆ Operation and characteristics of the following diodes: LED, SCR, Schottky, Photoconductive, varactor, varistor, Zener

Evidence Requirements

Evidence for the knowledge and/or skills in this Outcome will be provided by a closed-book examination taken at a single assessment lasting 45 minutes and carried out under supervised, controlled conditions. In any assessment of this Outcome all of the knowledge and/or skills items should be tested.

Assessment Guidelines

Questions used to elicit candidate evidence may take the form of an appropriate balance of short answer, restricted response and structured questions. All of the knowledge and skills section should be tested. Candidates should be allowed to use a scientific calculator.

Higher National Unit specification: statement of standards (cont)

Unit title: Electronic Fundamentals for Aviation

The assessment instruments used for assessing this Unit should follow the general guidelines offered by the Scottish Qualification Authority (SQA) assessment model. Each centre should make a model answer as a marking guide for each question asked and candidates awarded marks for key points and presentation of answers. Candidates can supplement written answer with sketches and diagrams to clarify points and be allowed to use scientific calculators to carry out any calculation.

For candidates who fail to achieve the pass mark for each assessment, centres may allow candidates to re-sit the assessments at an appropriate time using different questions.

The assessment of this Outcome can be combined with Outcomes 2 and 4 to form a single assessment paper for the Unit, details of which are given at the end of this section.

Outcome 2

Describe simple BJT (By Junction Transfer) principles and common applications

Knowledge and/or Skills

- ◆ Symbols of NPN and PNP BJTs
- ◆ Operation of BJTs
- ◆ Characteristics of BJTs
- ◆ Simple BJT circuits including bias and decoupling
- ◆ Multistage circuit principles

Evidence Requirements

Evidence for the knowledge and/or skills in this Outcome will be provided by a closed-book examination taken at a single assessment event lasting 45 minutes and carried out under supervised, controlled conditions. The evidence may be presented in responses to specific questions. In any assessment of this Outcome all of the knowledge and/or skills items should be tested.

Assessment Guidelines

Questions used to elicit candidate evidence may take the form of an appropriate balance of short answer, restricted response and structured questions. All the knowledge and skills section should be tested. Candidates should be allowed to use a scientific calculator.

The assessment instruments used for assessing this Unit should follow the general guidelines offered by the Scottish Qualification Authority (SQA) assessment model. Each centre should make a model answer as a marking guide for each question asked and candidates awarded marks for key points and presentation of answers. Candidates can supplement written answer with sketches and diagrams to clarify points and be allowed to use scientific calculators to carry out any calculation.

For candidates who fail to achieve the pass mark for each assessment, centres may allow candidates to re-sit the assessments at an appropriate time using different set of questions.

The assessment of this Outcome can be combined with Outcomes 1 and 4 to form a single assessment paper for the Unit, details of which are given at the end of this section.

Higher National Unit specification: statement of standards (cont)

Unit title: Electronic Fundamentals for Aviation

Outcome 3

Describe operational amplifier principles and common applications.

Knowledge and/or Skills

- ◆ Schematic circuit symbols used for operational amplifiers
- ◆ Operational Amplifier Characteristics (ideal and typical)
- ◆ Common Operational Amplifier circuits including: inverting, non-inverting, summing, integrator, differentiator
- ◆ Positive and negative feedback

Evidence Requirements

Evidence for the knowledge and/or skills in this Outcome will be provided by a case study/investigation on the knowledge and skills of this Outcome. In any assessment of this Outcome all of the knowledge and/or skills items should be tested.

Assessment Guidelines

A series of structured prompts can be used to steer the candidate through an investigation/case study. The candidate should be encouraged to utilise simulation software as part of the way in which he/she presents their findings. The case study/investigation should have some structured questions to prompt the candidate to investigate the knowledge and skills section thoroughly.

The assessment instruments used for assessing this Unit should follow the general guidelines offered by the Scottish Qualification Authority (SQA) assessment model. Each centre should make a model answer as a marking guide for each question asked and candidates awarded marks for key points and presentation of answers. Candidates can supplement written answer with sketches and diagrams to clarify points and be allowed to use scientific calculators to carry out any calculation.

For candidates who fail to achieve the pass mark for each assessment, centres may allow candidates to re-sit the assessments at an appropriate time using different case study/investigation.

Outcome 4

Describe combinational logic circuits and simple applications

Knowledge and/or skills

- ◆ Logic symbols for — NAND, NOR, NOT, AND/OR XOR, XNOR
- ◆ Truth tables for two input versions of NAND, NOR, AND/OR XOR, XNOR
- ◆ Truth tables for the NOT function
- ◆ Simple combinational logic circuits and associated truth tables
- ◆ Characteristics of CMOS and TTL logic

Higher National Unit specification: statement of standards (cont)

Unit title: Electronic Fundamentals for Aviation

Evidence Requirements

Evidence for the knowledge and/or skills in this Outcome will be provided by a closed-book examination taken at a single assessment event lasting 45 minutes and carried out under supervised, controlled conditions. The evidence may be presented in responses to specific questions. In any assessment of this Outcome all of the knowledge and/or skills items should be tested.

Assessment Guidelines

Questions used to elicit candidate evidence may take the form of an appropriate balance of short answer, restricted response and structured questions. All the knowledge and skills section should be tested. Candidates should be allowed to use a scientific calculator.

The assessment instruments used for assessing this Unit should follow the general guidelines offered by the Scottish Qualification Authority (SQA) assessment model. Each centre should make a model answer as a marking guide for each question asked and candidates awarded marks for key points and presentation of answers. Candidates can supplement written answer with sketches and diagrams to clarify points and be allowed to use scientific calculators to carry out any calculation.

For candidates who fail to achieve the pass mark for each assessment, centres may allow candidates to re-sit the assessments at an appropriate time using different questions.

The assessment of this Outcome can be combined with Outcomes 1 and 2 to form a single closed-book assessment paper for the Unit, details of which are given below.

If it is decided to use a single holistic assessment, then the single assessment paper could be taken at a single assessment event lasting two hours and carried out under supervised, controlled conditions. Evidence for the knowledge and/or skills for Outcomes 1, 2 and 4 will be provided by an examination. The evidence may be presented in responses to specific questions. In any assessment of this Unit all of the knowledge and/or skills items should be tested.

In order to ensure that candidates will not be able to foresee the exact form of the assessment, a different examination is required each time the Unit is assessed.

Such a paper could be composed of an appropriate balance of short answer, restricted response and structured questions. Candidates should be allowed to use a non-programmable scientific calculator to enable them to carry out calculations.

Administrative Information

Unit code: DR07 34

Unit title: Electronic Fundamentals for Aviation

Superclass category: XP

Date of publication: August 2005

Version: 03 (May 2009)

History of changes:

Version	Description of change	Date
02	Change to assessment time for Outcome 4.	30/10/08
03	Acronym in full for Outcome 2, ie BJT (By Junction Transfer).	21/05/09

Source: SQA

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Higher National Unit specification: support notes

Unit title: Electronic Fundamentals for Aviation

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 is a Mandatory Unit devised for the principals and technology section of the HNC/HND Aircraft Engineering Group Award. The Unit is intended to give candidates an in-depth knowledge of some of the range of electronic devices likely to be encountered on an aircraft. The Unit provides partial coverage of EASA 66 Module 4, Chapter 4.1.

Whilst many approaches can be utilised for the delivery of the above material it is desirable to set them in the context of the aviation technician. Wherever possible the delivery of the curriculum material in this Unit should utilise practical examples of where the concepts may be found on an aircraft.

In aviation maintenance a technician must be familiar with aircraft electronic systems. By understanding the principles of basic electronic devices and their circuit applications the technician can effectively diagnose, isolate and repair aircraft electrical/electronic problems.

Wherever possible you should endeavour to provide the candidate with practical examples to work with. Where this is not practicable or possible simulation software should be used to confirm/visualise concepts and results.

Content/context corresponding to Outcomes

- 1 Candidates should be introduced to the PN junction diode. This should include junction operation, characteristics, and a variety of applications. Candidates should then be introduced to a variety of specialist diode devices — LEDs, SCRs, Schottky, Photoconductive, Zener, Varactor and Varistor, giving examples of operation and application.
- 2 Candidates should be introduced to the BJT (NPN and PNP). Giving candidates an understanding of transistor operation, symbols, characteristics and simple circuits. The emphasis should be placed on the candidates understanding of how the transistor works and how it can be applied to simple circuits. Finally, candidates should be given the opportunity to appreciate how transistor circuits can be cascaded into multistage systems. The simplest to conceptualise is probably a two stage common emitter amplifier.
- 3 Candidates should start with the symbol and ideal characteristics of the operational amplifier. The concepts of open and closed loop system should be explored together with positive and negative feedback. To conclude candidates should be given the opportunity to explore the operation of a variety of op-amp circuits (inverting amp, non-inverting amp, summing amp, integrator, differentiator). The operation of these circuits could be verified by circuit build or computer simulation.

Higher National Unit specification: support notes (cont)

Unit title: Electronic Fundamentals for Aviation

- 4 Candidates should be introduced to the range of building blocks that can constitute a combinational logic circuit, namely — NAND, NOR, NOT, AND, OR, XOR, XNOR. The focus should be on an understanding of two input gates and coverage should include truth tables and understanding simple combinational circuits (maximum 4 inputs). Candidates should be able to verify circuit operation by computer simulation or circuit build and appreciate the characteristics of both TTL and CMOS technologies.

Guidance on the delivery and assessment of this Unit

Assessment of this Unit is to be carried out by centres using the assessment instruments they consider most appropriate, although assessment instruments used should follow the general guidelines offered by the Scottish Qualification Authority (SQA). All assessments should be carried out under controlled condition and candidates should not be allowed to bring in textbooks, handouts or other prepared material.

Opportunities for developing Core Skills

There may be opportunities in this Unit to gather evidence towards the Core Skills of *Numeracy* at Higher level, *Problem Solving* at Higher level and *IT* at Intermediate 2 level, although there is no automatic certification of Core Skills or Core Skills components.

Open learning

The Unit would be suitable for open and distance learning. The mode of delivery would be the same as other distance-learning units by a range of self-study and tutor based assignments. Candidates would have to attend an approved centre for assessment events.

Disabled candidates and/or those with additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering whether any reasonable adjustments may be required. Further advice can be found on our website www.sqa.org.uk/assessmentarrangements

General information for candidates

Unit title: Electronic Fundamentals for Aviation

The Unit is intended for those who are interested in aircraft engineering and is offered as an optional Unit in the HNC/HND Aircraft Engineering Group Award.

This Unit provides partial coverage of EASA 66 Module 4, Chapter 4.1

The Unit is designed to introduce you to a range of common electronic devices that you could encounter on an aircraft. The emphasis of the Unit is on understanding the operation and application of these electronic devices. It would be useful if you had completed the Unit Electrical Fundamentals for Aviation.

The Unit has four main areas, each area covered by a separate Outcome. On completion of the Unit you will be able to:

- 1 Describe simple diode principles and common applications.
- 2 Describe simple BJT (By Junction Transfer) principles and common applications.
- 3 Describe operational amplifier principles and common applications.
- 4 Describe combinational logic circuits and simple applications.

Assessment of the Unit will be on an Outcome by Outcome basis or by an end of Unit examination. The exception of this is Outcome 3, which is assessed by means of an investigation or case study.

All examinations for this Unit are carried out under closed-book conditions. You will not therefore be permitted to bring textbooks, handouts or other material into the assessment event.

You are permitted to bring a non-programmable scientific calculator into the examinations for this Unit.