

Higher National Unit Specification

General information for centres

Unit title: Electrical Fundamentals for Aviation

Unit code: DR06 34

Unit purpose: This Unit is designed to give candidates an introduction to a variety of electrical principles needed to develop an understanding of aircrafts avionic and electrical systems. This Unit also provides part of the underpinning knowledge components for the EASA Part 66 Module 3, Chapters Part 3.3, 3.4, 3.5, 3.6, 3.8, 3.13, 3.14.

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

- 1 Investigate common sources of DC and AC electricity.
- 2 Solve DC electrical network problems.
- 3 Solve AC electrical network problems.

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 DR0A 33 Physics and Maths for Aviation or an appropriate Mathematics NQ unit before commencing this Unit.

Core skills: There may be opportunities in this Unit to gather evidence towards the Core Skills of Numeracy and Problem Solving Core Skills at Higher 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.

Assessment: Candidates can be assessed on an outcome by outcome basis or by a single assessment combining all three Outcomes. 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.

General information for centres (cont)

Unit title: Electrical Fundamentals for Aviation

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: Electrical Fundamentals for Aviation

Unit code: DR06 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 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

Investigate common sources of DC and AC Electricity

Knowledge and/or skills

- ◆ construction and basic chemical action of — primary cells, secondary cells, lead acid cells, nickel cadmium cells and alkaline cells
- ◆ cells connected in series and parallel
- ◆ definition of DC
- ◆ definition of DC voltage and current
- ◆ definition of AC
- ◆ AC generation and distribution

Evidence requirements

Evidence for the knowledge and/or skills in this Outcome will be provided by and investigative written report which provides coverage of the skills and knowledge. In any assessment of this Outcome all of the knowledge and/or skills items should be tested.

Assessment guidelines

A case study approach may be adopted as a means of prompting the candidate to investigate the types of cells used in aircraft systems together with coverage of their sources of electricity. The centres should provide a series of structured questions to prompt the candidate to investigate the knowledge and skills section thoroughly.

Higher National Unit specification: statement of standards (cont)

Unit title: Electrical 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 minimum evidence for each assessment, centres may allow candidates to re-sit the assessments at an appropriate time using a different set of questions.

The assessment of this Outcome can be combined with the other outcomes to form a single assessment paper for the unit, details of which are given at the end of this section.

Outcome 2

Solve DC electrical network problems

Knowledge and/or skills

- ◆ Ohms Law
- ◆ simple series resistive circuits
- ◆ simple parallel resistive circuits
- ◆ simple series/parallel circuits
- ◆ Kirchoffs voltage and current laws
- ◆ power

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.

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 Outcome is assessed.

Assessment guidelines

Questions used to elicit candidate evidence may take the form of an appropriate balance of short answer, restricted response and structured questions. 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.

Higher National Unit specification: statement of standards (cont)

Unit title: Electrical Fundamentals for Aviation

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

The assessment of this Outcome can be combined with the Outcome 3, details of which are given at the end of this section.

Outcome 3

Solve AC electrical network problems

Knowledge and/or skills

- ◆ sinusoidal waveforms — phase, period, frequency, cycle
- ◆ RMS, instantaneous, peak, peak to peak and average values in respect to voltage, current and power
- ◆ calculating the circuit quantities voltage drop, current, resistance, reactance and power (true, apparent and reactive) in the following circuits;
- ◆ series RC circuits
- ◆ series RL circuits
- ◆ series RLC circuits

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 60 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.

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 minimum evidence for each assessment, centres may allow candidates to re-sit the assessments at an appropriate time using a different set of questions.

The assessment of this Outcome can be combined with outcome 2, details of which are given at the end of this section.

Higher National Unit specification: statement of standards (cont)

Unit title: Electrical Fundamentals for Aviation

If it is decided to use a single assessment, for Outcomes 2 and 3, then the single closed-book assessment paper could be taken at a single assessment lasting (one hour and forty five minutes) and carried out under supervised, controlled conditions. However, Outcome 1 should be presented in the form of a case study to elicit the candidates understanding of power sources utilised on aircraft. 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.

Administrative Information

Unit code:	DR06 34
Unit title:	Electrical Fundamentals for Aviation
Superclass category:	XP
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Higher National Unit specification: support notes

Unit title: Electrical 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 candidate an introductory knowledge and understanding of electrical circuit principles. The Unit also provides partial coverage of the EASA Module 3.

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. Where ever possible delivery of the curriculum should be made by utilising examples of where the concepts may be found on an aircraft.

In aviation maintenance a technician must be familiar with aircraft electrical systems. By understanding the principles of electricity and simple AC and DC circuits the technician can effectively diagnose, isolate and repair aircraft electrical 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 concept of DC electricity — Voltage, Current and Resistance. Following on from this, candidates should cover the technology involved in the construction and basic chemical action of: Primary cells, Secondary Cells, Lead Acid Cells, Nickel Cadmium Cells and Alkaline Cells. In addition, candidates should be made aware of the effects of connecting cells in series and parallel. Candidates should then be introduced to the principles of AC electrical generation (single phase) and distribution.
- 2 Candidates should be given the opportunity to develop the DC themes outlined in Outcome 1. These should include solving simple DC circuits involving power, resistors in series, in parallel and series/parallel circuits. It is important to try and give the candidate as many examples as possible of these circuits and it would probably be appropriate to have a wide variety of tutorial examples for them to practice with. To conclude this Outcome the candidate should be introduced to Kirchoff's Current and Voltage laws. Again it is recommended that centres give the candidate a wide variety of tutorial examples to practice on.
- 3 Outcome 3 is designed to apply the knowledge and understanding developed in Outcomes 1 and 2 and expand it for AC circuits. Starting with Sinusoidal waveforms — phase, period, frequency, cycle, RMS, instantaneous, peak, peak to peak and average values in respect to voltage, current and power. Moving on to calculating the circuit quantities voltage drop, current, resistance, reactance and power (true, apparent and reactive) on RL, RC and RLC circuits. Again it is important for centres to provide many opportunities for candidates to practice the concepts outlined in this Unit.

Guidance on the delivery and assessment of this Unit

Unit title: Electrical Fundamentals for Aviation

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. Having access to relevant publications is recommended and course work and assignment reports must be the work of individuals.

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 are no opportunities to develop Core Skills in this Unit.

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.

Candidates with additional support needs

This Unit specification is intended to ensure that there are no artificial barriers to learning or assessment. The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative Outcomes for Units. For information on these, please refer to the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs*, which is available on the SQA website **www.sqa.org.uk**.

General information for candidates

Unit title: Electrical Fundamentals for Aviation

The Unit is intended for those who are interested in aircraft engineering and is offered as a mandatory Unit in the HNC/HND Aircraft Engineering Group Award. The Unit is designed to provide you with an understanding of the electrical principles needed to work in an aviation environment. This Unit is designed to precede the Unit Electronic Fundamentals for Aviation and is of particular interest to those wishing to pursue a career in avionics.

This Unit also provides part coverage of the EASA 66 Module 3, Chapters Part 3.3, 3.4, 3.5, 3.6, 3.8, 3.13, 3.14.

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

- 1 Investigate common sources of DC and AC electricity.
- 2 Solve DC electrical network problems.
- 3 Solve AC electrical network problems.

Assessment of the Unit will be on an outcome by outcome basis or by an investigation report covering Outcome 1 and a combined examination for Outcomes 2 and 3.

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 however, allowed to bring a non programmable scientific calculator with you into the examinations.