

## Higher National Unit Specification

### General information for centres

**Unit title:** Aircraft Electronic Techniques

**Unit code:** F0M4 35

**Unit purpose:** This Unit is designed to give candidates a knowledge of electromagnetic interference (EMI), noise and its effect on aircraft systems; applications of field effect transistors and the principles of printed circuit board (PCB) design. This Unit also provides part of the underpinning knowledge components for the EASA Part 66 Module 4 and 5, Chapters Part 4.2, 4.12 and 5.14.

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

- 1 Investigate the effect of electrostatic and noise interference on aircraft.
- 2 Analyse the operation and application of field effect transistors.
- 3 Apply printed circuit board design rules.

**Credit points and level:** 1 HN Credit at SCQF level 8: (8 SCQF credit points at SCQF level 8\*)

*\*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 pre-requisites, however it is recommended that candidates have completed Units: DR0A 33 *Mathematics and Physics for Aviation* and DR0D 33 *Aircraft Electrical and Electronic Skills* before commencing this Unit.

**Core Skills:** There are opportunities to develop the Core Skills of:

Problem Solving:	Critical Thinking at	SCQF level 5
Problem Solving:	Planning and Organising: at	SCQF level 5
Communication:	Reading at	SCQF level 6
Communication:	Writing at	SCQF level 6
Numeracy:	Using Number at	SCQF level 5
Numeracy:	Using Graphical Information at	SCQF level 5

in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

## **General information for centres (cont)**

**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 combining Outcomes 1 and 2. The assessments could be composed of an appropriate balance of structured questions, practical assignment and investigative report.

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:** Aircraft Electronic Techniques

**Unit code:** F0M4 35

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.

### **Outcome 1**

Investigate the effect of electrostatic and noise interference on aircraft

#### **Knowledge and/or skills**

- ◆ Airborne electrostatic charge
- ◆ Airborne electrostatic charge protection
- ◆ On board electromagnetic interference
- ◆ On board electromagnetic interference protection

#### **Evidence Requirements**

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ investigate the causes of electrostatic / electromagnetic interference and methods to protect the aircraft / aircraft systems

#### **Assessment guidelines**

Evidence for the knowledge and/or skills in this Outcome could be provided by an investigative report which provides coverage of the knowledge and skills. In any assessment of this Outcome a sample of the knowledge and/or skills items should be tested, the sample being either items one and two or items three and four.

A case study approach may be adopted as a means of prompting the candidate to investigate aircraft electromagnetic / electrostatic interference. 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:** Aircraft Electronic Techniques

### Outcome 2

Analyse the operation and application of field effect transistors

#### Knowledge and/or skills

- ◆ MOSFET
- ◆ Structure
- ◆ Depletion mode
- ◆ Enhancement mode
- ◆ Biasing
- ◆ Applications

#### Evidence Requirements

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ illustrate the structures and describe operating characteristics and parameters of both devices. Candidates should be able to calculate a range of device parameters and suggest likely applications for the devices

#### Assessment guidelines

Evidence for the knowledge and/or skills in this Outcome could be provided by a closed-book examination. The assessment, lasting 45 minutes, should be carried out under supervised, controlled conditions, and use structured questions. In any assessment of this Outcome a sample of the knowledge and/or skills items should be tested. The sample being, item one or item two. In all cases items three and four should be tested.

### Outcome 3

Apply printed circuit board design rules

#### Knowledge and/or skills

- ◆ PCB design rules:
  - Pad size
  - Track width
  - Capacitance
  - Noise
  - Board size
- ◆ Schematic interpretation
- ◆ Pitch calculation
- ◆ Component recognition
- ◆ Software

## **Higher National Unit specification: statement of standards (cont)**

**Unit title:** Aircraft Electronic Techniques

### **Evidence Requirements**

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ interpret a given schematic, use PCB design software and apply design rules to produce an appropriate PCB design

### **Assessment guidelines**

Evidence for the knowledge and/or skills in this Outcome could be provided by a practical assignment. In any assessment of this Outcome all of the knowledge and/or skills items should be tested.

## Administrative Information

**Unit code:** F0M4 35

**Unit title:** Aircraft Electronic Techniques

**Superclass category:** XP

**Original date of publication:** August 2006

**Version:** 01

### History of Changes:

Version	Description of change	Date

**Source:** SQA

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## Higher National Unit specification: support notes

### Unit title: Aircraft Electronic Techniques

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 Unit is intended to give the candidate an introductory knowledge of aircraft generators and key electrical system components. The Unit also provides partial coverage of the EASA Module 4 and 5.

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 delivery of the content 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 electromagnetic environment and the issues associated with it. Technicians must also understand how to avoid issues caused by electromagnetic interference. Technicians must be aware of how basic electronic devices function and are incorporated into PCBs to allow them to effectively diagnose, isolate and repair aircraft 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 concept of electromagnetic and electrostatic interference. The candidate should cover the main sources of aircraft interference and preventative measures which can be adopted for either on board the aircraft or airborne interference.
- 2 Candidates should be introduced to basic MOSFETs, moving on to understand the basic construction of the devices and the modes of operations. This should be followed by discussion of biasing and the requirements of achieving each mode of operation. The candidate should then be introduced to the concept of transconductance and calculations of parameters eg  $V_{GS}$ ,  $I_D$   $V_{DS}$  etc. Finally applications of the devices should be discussed. It is recommended that centres give the candidate a variety of tutorial examples to allow the candidate to practise providing responses which provide circuit analysis.
- 3 Candidates should be introduced to electronic schematic diagrams and recognition of common components. Moving on to the concept of printed circuit board (PCB) design rules, discussing the reasoning for the rules and covering areas such as pad size, track width, capacitance, noise, board size, pitch etc. Candidates should then be introduced to a PCB design package. It is recommended that centres give candidates a variety of tutorial examples to allow the candidate practice at applying the design rules and using the software.

## Higher National Unit specification: support notes (cont)

**Unit title:** Aircraft Electronic Techniques

### Guidance on the delivery and assessment of this Unit

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 opportunities to develop the following Core Skills:

- ◆ Problem Solving: Critical Thinking at SCQF level 5. This can be achieved by candidates demonstrating their ability to analyse electronic circuit operation.
- ◆ Problem Solving: Planning and Organising at SCQF level 5. This can be achieved by candidates demonstrating their ability to time plan and time manage completion of their report.
- ◆ Communication: Reading at SCQF level 6. This can be achieved by candidates demonstrating their ability to interpret and analyse written information on engineering concepts and data.
- ◆ Communication: Writing at SCQF level 6. This can be achieved by candidates demonstrating their ability to respond to questions requiring analysis, and description, and to produce a written technical report.
- ◆ Numeracy: Using Number at SCQF level 5. This can be achieved by candidates demonstrating their ability to perform calculations using algebra.
- ◆ Numeracy: Using Graphical Information at SCQF level 5. This can be achieved by candidates demonstrating their ability to interpret characteristic curves.

### 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 disabilities and/or additional support needs

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 Alternative Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs*, which is available on SQA's website: [www.sqa.org.uk](http://www.sqa.org.uk).

## General information for candidates

### Unit title: Aircraft Electronic Techniques

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. This Unit is designed to give you a knowledge of electromagnetic phenomena which influence maintenance practices on aircraft electronic systems. The unit also introduces a common electronic device, the field effect transistor, and the applications for the device. The principles of PCB design will enhance your knowledge of the construction of aircraft electronic systems and assist with fault finding and handling of aircraft electronic systems. This Unit is of particular interest to those wishing to pursue a career in avionics.

This Unit also provides part of the underpinning knowledge components for the EASA Part 66 Module 4 and 5, Chapters Part 4.2, 4.12 and 5.14.

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

- 1 Investigate the effect of electrostatic and noise interference on aircraft

You will be able to investigate the causes of electrostatic and electromagnetic interference and methods to protect the aircraft and aircraft systems.

- 2 Analyse the operation and application of field effect transistors.

You will be able to illustrate the structures and describe operating characteristics and parameters of field effect transistors and devices, calculate a range of device parameters and suggest likely applications for the devices.

- 3 Apply printed circuit board design rules.

You will be able to interpret an electronic schematic diagram, use PCB design software and apply design rules to produce an appropriate PCB design.

Assessment of the Unit will usually be carried out by an investigation report covering Outcome 1, an examination covering Outcome 2, and a practical assignment covering Outcome 3. All assessments for this Unit will be 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 examination.