

Higher National Unit Specification

General information for centres

Unit title: Aircraft Instruments

Unit code: DP5M 34

Unit purpose: This Unit is designed to allow candidates to acquire the knowledge and understanding of principles, functions, operation and maintenance of some basic aircraft instrument systems. It covers the knowledge about aircraft instrument required for EASA Part 66 B1 license (part of module 11 in EASA Part 66 requirements) or for EASA Part 66 B2 license (part of module 13 in EASA Part 66 requirements).

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

- 1 Explain the fundamentals of aircraft instrument displays.
- 2 Explain the principles, functions, operation and maintenance of air data and air data systems.
- 3 Explain the principles, functions, and operation of gyroscopic flight instruments.

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 candidates have complete Higher National Unit 'Mathematics and Physics for Aviation'.

Core Skills: In this Unit, there may be opportunities to gather evidence towards Core Skills, 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 are assessed either on an Outcome by Outcome basis or by a single assessment combining all three Outcomes. The assessment papers could be composed of an appropriate balance of short answer, restricted response and structured questions. Assessment should be carried out on a sample basis and under supervised, closed-book, controlled conditions.

General information for centres (cont)

Unit title: Aircraft Instruments

In order to achieve this unit, candidates are required to present sufficient evidence that they have met all the requirements for each Outcome within the evidence requirements specified. Details of these requirements are given for each Outcome. The assessment instruments used should follow the general guidance offered by the Scottish Qualifications Authority (SQA) assessment model and an integrative approach to assessment is encouraged. (See references at the end of support notes).

Accurate records should be made of the assessment instruments used showing how evidence is generated for each Outcome and 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 Instruments

Unit code: DP5M 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.

Outcome 1

Explain the fundamentals of aircraft instrument displays

Knowledge and/or skills

- ◆ instrument requirements
- ◆ displays of quantitative and qualitative information
- ◆ aircraft instrument panel layout
- ◆ analogue displays
- ◆ digital displays
- ◆ graphical displays and integrated displays

Evidence requirements

A candidate's response can be judged to be satisfactory where the evidence provided is sufficient to meet the requirements for each item by showing that the candidate has correct understanding or skills in:

- ◆ Instrument requirements which are laid down by the international standard of airworthiness.
- ◆ Displays of quantitative and qualitative information: Scale and operating ranges; Accuracy of displays; Easy readability of displays; Operational range markings; On-off information.
- ◆ Aircraft instrument panel layout: Location, visibility and grouping of instruments.
- ◆ Analogue displays: Different type of scales in instrument displays; Accuracy and readability; Mechanical transformers for analogue instrument displays; Electrical-mechanical transformers (synchro systems).
- ◆ Digital Displays: Display configurations; Light-emitting diodes (LED); Liquid crystal display (LCD).
- ◆ Graphical displays and integrated displays: Cathode ray tube (CRT); Liquid crystal display (LCD).

Assessment guidelines

The assessment of this Unit should be carried out by an examination taken as a single assessment lasting forty minutes or by a single two-hour assessment combining all three Outcomes, and carried out under supervised, closed-book, controlled conditions.

Higher National Unit specification: statement of standards (cont)

Unit title: Aircraft Instruments

Where the knowledge is sampled, the sample should comprise at least four bullet points listed under knowledge and/or skills. In order to ensure that candidates will not be able to foresee the sample, the whole of the content listed must be taught and available for assessment. Moreover, a different sample is required each time the Outcome is assessed, to which candidates must give a satisfactory response. The evidence may be presented in responses to specific questions.

Outcome 2

Explain the principles, functions, operation and maintenance of air data and air data systems

Knowledge and/or skills

- ◆ the Earth's Atmosphere
- ◆ air data measurements
- ◆ the principles, functions and operation of altimeters
- ◆ the principles, functions and operation of airspeed indicators
- ◆ the principles, functions and operation of Machmeters
- ◆ the principles, functions and operation of vertical speed indicators
- ◆ angle of attack and stall warning systems

Evidence requirements

A candidate's response can be judged to be satisfactory where the evidence provided is sufficient to meet the requirements for each item by showing that the candidate has correct understanding or skills in:

- ◆ The Earth's Atmosphere: Composition of air; Atmospheric pressure (static) and pressure measurements pressure; Atmosphere air density; Atmosphere air temperature; International standard atmosphere.
- ◆ Air data measurements: The air data quantities and their importance; Pitot/static sensors; Pitot/static pipelines and couplings; Pressure errors checks.
- ◆ Altimeter: Atmosphere pressure variation; Altimeter construction; Barometric pressure datum setting; Effect of atmospheric temperature on an altimeter; Altimeter indication.
- ◆ Airspeed Indicators: Speed indicator construction; Impact pressure (or dynamic pressure); "Square law" correction; Airspeed terminologies; Instrument dial markings.
- ◆ Machmeters: Speed of sound; Machmeter construction.
- ◆ Vertical Speed Indicators: Mechanism and construction; Leaking assembly.
- ◆ Angle of attack and stall warning systems.

Assessment guidelines

The assessment of this Unit should be carried out by an examination taken as a single assessment lasting forty minutes or by a single two-hour assessment combining all three Outcomes, and carried out under supervised, closed-book, controlled conditions.

Higher National Unit specification: statement of standards (cont)

Unit title: Aircraft Instruments

Where the knowledge is sampled, the sample should comprise at least four bullet points listed under knowledge and/or skills. In order to ensure that candidates will not be able to foresee the sample, the whole of the content listed must be taught and available for assessment. Moreover, a different sample is required each time the Outcome is assessed, to which candidates must give a satisfactory response. The evidence may be presented in responses to specific questions.

Outcome 3

Explain the principles, functions, and operation of gyroscopic flight instruments

Knowledge and/or skills

- ◆ basic principles of gyroscope
- ◆ construction of a gyroscope
- ◆ gyro indication errors
- ◆ gyroscope erection
- ◆ gyro horizon
- ◆ direction indicator
- ◆ rate gyroscope
- ◆ turn-and-slip indicator

Evidence requirements

A candidate's response can be judged to be satisfactory where the evidence provided is sufficient to meet the requirements for each item by showing that the candidate has correct understanding or skills in:

- ◆ Basic principles of gyroscope: Rigidity; Precession.
- ◆ Construction of a gyroscope: Rotor; Gimbal; Sources of power for gyros.
- ◆ Gyro indication errors: Drift and transport wander of a free gyroscope; Gimbals lock and gimbals error.
- ◆ Gyroscope erection: Pendulous jet unit; Mercury switch systems and electrical erection unit; Electrical artificial horizon.
- ◆ Gyro horizon: Principle of operation; Construction; Pitch indication; Roll indication.
- ◆ Direction indicator: Principle of operation; Construction; Indication.
- ◆ Rate gyroscope: Principle of operation; Construction; Indication.
- ◆ Turn-and-slip indicator: Principle of operation; Construction; Indication.

Assessment guidelines

The assessment of this Unit should be carried out by an examination taken as a single assessment lasting forty minutes or by a single two-hour assessment combining all three Outcomes, and carried out under supervised, closed-book, controlled conditions.

Where the knowledge is sampled, the sample should comprise at least four bullet points listed under knowledge and/or skills. In order to ensure that candidates will not be able to foresee the sample, the whole of the content listed must be taught and available for assessment. Moreover, a different sample is required each time the Outcome is assessed, to which candidates must give a satisfactory response. The evidence may be presented in responses to specific questions.

Administrative Information

Unit code:	DP5M 34
Unit title:	Aircraft Instruments
Superclass category:	XP
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Higher National Unit specification: support notes

Unit title: Aircraft Instruments

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 xx hours.

Guidance on the content and context for this Unit

This Unit is designed to allow candidates to acquire the knowledge and understanding of principles, functions, operation and maintenance of some basic aircraft instrument systems.

Corresponding to Outcomes:

- 1 Explain the fundamentals of aircraft instrument displays
 - ◆ Instrument requirements which are laid down by the international standard of airworthiness
 - reliability
 - weight
 - maintainability
 - integration
 - ‘standardised’
 - ‘friendly interfaced’
 - ◆ Displays of quantitative and qualitative information
 - scale and operating ranges
 - accuracy of displays
 - range and scale length
 - scale space
 - graduation marks
 - linear scale (or evenly spaced scale);
 - square law scale;
 - logarithmic scale.
 - easy readability of displays
 - operational range markings
 - warning and prohibiting area
 - colour code for operational range markings
 - on-off information
 - symbol, light and colour for on-off information
 - ◆ Aircraft instrument panel layout
 - location, visibility and grouping of instruments
 - t-type flight deck instrument layout
 - engine measurement display layout

Higher National Unit specification: support notes (cont)

Unit title: Aircraft Instruments

- ◆ Analogue displays
 - circular scale
 - high-range long-scale displays
 - straight scale
 - dual-indicator displays
 - mechanical transformers for analogue instrument displays
 - lever, gear, and pinion
 - electrical-mechanical transformers (synchro systems): principles and applications
 - torque synchro systems
 - control synchro systems
 - resolver
 - differential synchro systems

 - ◆ Digital displays
 - display configurations
 - 13 and 16 segment alphanumeric displays
 - dot matrix displays
 - light-emitting diodes (LED)
 - liquid crystal display (LCD)

 - ◆ Graphical displays and integrated displays
 - cathode ray tube (CRT)
 - liquid crystal display (LCD)
- 2 Explain the principles, functions, operation and maintenance of air data and air data systems.
- ◆ The earth's atmosphere
 - composition of air
 - pressure (static) and pressure measurements
 - atmospheric pressure
 - barometers
 - gauge pressure and absolute pressure
 - pressure gauge calibration
 - atmosphere air density
 - air temperature
 - international standard atmosphere

 - ◆ Air data measurements
 - the air data quantities and their importance
 - static pressure and impact pressure
 - pitot/static sensors
 - pitot tube, static tube, static vent, and combined pressure head
 - heating and drainage
 - pitot/static pipelines and couplings
 - identification and installation
 - moisture in pipeline and moisture drain traps
 - inspection and maintenance
 - pressure errors checks

Higher National Unit specification: support notes (cont)

Unit title: Aircraft Instruments

- ◆ Altimeter
 - atmosphere pressure variation
 - altimeter construction
 - barometric pressure datum setting
 - pressure altitude
 - indicated altitude
 - effect of atmospheric temperature on an altimeter
 - air temperature sensing
 - altimeter indication

 - ◆ Airspeed indicators
 - speed indicator construction
 - impact pressure (or dynamic pressure)
 - ‘square law’ correction
 - airspeed terminologies
 - instrument dial markings

 - ◆ Machmeters
 - speed of sound
 - machmeter construction

 - ◆ Vertical Speed Indicators
 - mechanism and construction
 - leaking assembly

 - ◆ angle of attack and stall warning systems
- 3 Explain the principles, functions, and operation of gyroscopic flight instruments
- ◆ Basic principles of gyroscope
 - rigidity
 - precession

 - ◆ Construction of a gyroscope
 - rotor
 - gimbal
 - sources of power for gyros

 - ◆ Drift and transport wander of a free gyroscope

 - ◆ Gimbals lock and gimbals error

Higher National Unit specification: support notes (cont)

Unit title: Aircraft Instruments

- ◆ Gyroscope erection
 - pendulous jet unit
 - mercury switch systems and electrical erection unit
 - electrical artificial horizon

- ◆ Gyro horizon
 - principle of operation
 - construction of gyro horizon
 - pitch indication
 - roll indication

- ◆ Direction indicator
 - principle of operation
 - construction
 - indication.

- ◆ Rate gyroscope
 - principle of operation
 - construction
 - indication

- ◆ Turn-and-slip indicator
 - principle of operation
 - construction
 - indication

Guidance on the delivery and assessment of this Unit

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skill 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.

It is possible to assess candidates either on an Outcome by Outcome basis or by a single two-hour holistic assessment combining all three Outcomes. The assessment papers could be composed of an appropriate balance of short answer, restricted response and structured questions. Assessment should be carried out under closed-book, supervised, controlled conditions.

Higher National Unit specification: support notes (cont)

Unit title: Aircraft Instruments

Open learning

If this Unit is delivered by open or distance learning methods, additional planning and resources may be required for candidate support, assessment and quality assurance.

A combination of new and traditional authentication tools may have to be devised for assessment and re-assessment purposes.

For further information and advice, please see *Assessment and Quality Assurance for Open and Distance Learning* (SQA, February 2001 — publication code A1030).

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: Aircraft Instruments

In this Unit you will acquire the knowledge and understanding of principles, functions, operation and maintenance of some basic aircraft instrument systems. It covers the knowledge about aircraft instrument required for EASA Part 66 B1 license (part of module 11 in EASA Part 66 requirements) or for EASA Part 66 B2 license (part of module 13 in EASA Part 66 requirements). There are three Outcomes:

This Unit is designed to allow you to:

- 1 Explain the fundamentals of aircraft instrument displays.
- 2 Explain the principles, functions, operation and maintenance of air data and air data systems.
- 3 Explain the principles, functions, and operation of gyroscopic flight instruments.

This Unit will be beneficial if you are interested in aircraft engineering or are doing an aircraft engineering course.

You will be assessed either on an Outcome by Outcome basis or by a single two-hour assessment combining all three Outcomes. The assessment papers could be composed of an appropriate balance of short answer, restricted response and structured questions. Assessment should be carried out under closed-book, supervised, controlled conditions.