National Unit Specification: general information

UNIT Aeronautical Engineering Fundamentals (SCQF level 6)

CODE F5GM 12

SUMMARY

This Unit may form part of a National Qualification Group Award but may also be offered on a free-standing basis.

This introductory Unit is designed to allow candidates to develop a basic knowledge and understanding of Aeronautical Engineering. During delivery of the Unit candidates will learn to identify common aircraft types and explain their main roles. They will also develop the knowledge and understanding to identify main aircraft assemblies and describe their purpose. Candidates will also develop the knowledge and understanding of methods of thrust production and relate these to appropriate aircraft types. They will also learn to explain the theory of flight for particular aircraft types.

The Unit is suitable for candidates who:

- are undertaking the study of this subject for the first time
- wish to gain a basic knowledge of aeronautical engineering
- are considering a career in the aviation industry and wish to gain a basic knowledge and understanding of the subject

OUTCOMES

1 Explain the main roles and selection criteria for different types of aircraft.
2 Investigate aircraft assemblies in relation to aircraft types.
3 Investigate the methods of thrust production and relate these to aircraft types.
4 Explain the theory of flight for fixed wing and rotating wing aircraft.

Administrative Information

Superclass: XP

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Version: 01

National Unit Specification: general information (cont)

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RECOMMENDED ENTRY

While entry is at the discretion of the centre, it would be beneficial if candidates had attained one of the following, or equivalent:

- Standard Grade Physics (Credit level)
- Intermediate 2 Physics

CREDIT VALUE

1 credit at SCQF level 6 (6 SCQF credit points at SCQF level 6*).

**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.*

CORE SKILLS

There is no automatic certification of Core Skills in this Unit.

This Unit provides opportunities for candidates to develop aspects of the following Core Skill:

Communication (SCQF level 6)

These opportunities are highlighted in the Support Notes of this Unit Specification.

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National Unit Specification: statement of standards

UNIT Aeronautical Engineering Fundamentals (SCQF level 6)

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

OUTCOME 1

Explain the main roles and selection criteria for different types of aircraft.

Performance Criteria

(a) Identify correctly different types of aircraft.
(b) Explain accurately the roles of different types of aircraft.
(c) Explain correctly the choice of aircraft for particular roles in terms of given selection criteria.

OUTCOME 2

Investigate aircraft assemblies in relation to aircraft types.

Performance Criteria

(a) Identify correctly main aircraft assemblies for different aircraft types.
(b) Relate correctly main aircraft assemblies to corresponding aircraft types.
(c) Describe correctly the primary function of the main aircraft assemblies for different aircraft types.

OUTCOME 3

Investigate the methods of thrust production and relate these to aircraft types.

Performance Criteria

(a) State correctly the main methods of aircraft thrust production.
(b) Relate accurately main methods of aircraft thrust production to given aircraft types.
(c) Explain correctly the reasons for the use of particular types of thrust production in relation to the benefits they provide for given aircraft types.

OUTCOME 4

Explain the theory of flight for fixed wing and rotating wing aircraft.

Performance Criteria

(a) Identify correctly the forces acting on an aircraft in flight.
(b) Identify correctly the aircraft axes and their associated movement for aircraft in flight.
(c) Explain accurately the theory of flight in relation to fixed wing aircraft.
(d) Explain accurately the theory of flight in relation to rotating wing aircraft.

National Unit Specification: statement of standards (cont)

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EVIDENCE REQUIREMENTS FOR THIS UNIT

Evidence is required to demonstrate that candidates have achieved all Outcomes and Performance Criteria.

Written and/or recorded oral evidence is required which demonstrates that the candidate has achieved all Outcomes to the standard specified in the Outcome and Performance Criteria.

Outcomes 1, 2 and 3 must be assessed by a single, holistic assessment conducted at a single assessment event lasting no more than1 hour 30 minutes. The assessment must be conducted under supervised, closed-book conditions in which candidates may use reference materials provided by the centre but are not allowed to bring their own notes, handouts, textbooks or other materials into the assessment.

With regard to Outcome 1

- Candidates must be presented with three illustrations, one from each of the aircraft categories, Civilian, Military and Recreational. The candidate must identify each aircraft, describe the main role and suggest reasons why the aircraft would be suitable for the role.

- Selection criteria for given roles to include:
  - fuel efficiency
  - storage capacity
  - manoeuvrability
  - cost effectiveness
  - range

With regard to Outcome 2

- Candidates must be presented with two illustrations of aircraft types. The candidate must identify four different assemblies on each of the illustrations. The candidate must then describe the primary function of six of the main assemblies previously identified.

With regard to Outcome 3

- Candidates must be asked to list five of the main methods of aircraft thrust production. The candidate will match the previously listed methods of thrust production with five given illustrated aircraft types. The candidate must explain the reasons for the match of four types of thrust production to the corresponding aircraft types in terms of the benefits provided by each method of thrust production.

- Benefits of thrust production to include the following:
  - economy
  - power to weight ratio,
  - noise,
  - environmental issues

National Unit Specification: statement of standards (cont)

UNIT Aeronautical Engineering Fundamentals (SCQF level 6)

Outcome 4

Candidate evidence for Outcome 4 will be in the form of a description of approximately 500 words plus diagrams. Evidence for the Outcome will be produced under open-book conditions during supervised class time and candidates will be allowed access to notes, handouts, reference books and online help.

With regard to the description the candidate will:

- identify, with the aid of diagram(s), the following forces acting on an aircraft: lift, weight, thrust and drag
- identify, with the aid of diagram(s), the aircraft axes and the movement associated with these axes
- explain the generation of lift production for fixed and rotating wing aircraft (this should form the main body of the report)

The Assessment Support Pack for this Unit provides sample assessment material. Centres wishing to develop their own assessments should refer to the Assessment Support Pack to ensure a comparable standard.

National Unit Specification: support notes

UNIT Aeronautical Engineering Fundamentals (SCQF level 6)

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 forms part of the National Qualification Group Award in Aeronautical Engineering at SCQF level 6, but may also be offered on a free-standing basis.

The Unit is designed to give candidates an introduction to Aeronautical Engineering. On successful completion of the Unit candidates will be able to identify common aircraft types and explain their main roles. They will also have the knowledge and understanding to identify main aircraft assemblies and describe their purposes. Candidates will also have the knowledge and understanding to describe methods of thrust production and relate these to appropriate aircraft types. They will also be able to explain the theory of flight for particular aircraft types.

This Unit is designed to give candidates a basic overview of Aeronautical Engineering. Each of the subject areas in the Unit are developed further in other Units in the National Qualification Group Award in Aeronautical Engineering. Therefore, it is recommended that candidates studying the National Qualification Group Award in Aeronautical Engineering take this Unit at the beginning of the delivery of the Group Award.

The list below shows a suggested range of topics which may be delivered to candidates to support and underpin the requirements set out in the Outcomes, Performance Criteria and Evidence Requirements.

1 Explain the main roles and selection criteria for different types of aircraft.

- Identification of different aircraft types, aircraft roles explained and reasons why aircraft are selected for particular roles justified. Aircraft types may include:
  - Civilian — passenger, cargo, fire fighting, crop spraying, etc
  - Military — fighter, bomber, cargo, reconnaissance, UAV, re-fuelling etc
  - Recreational — aerobatic, hand gliding, autogyro etc

- Role justification to be based on the following selection criteria:
  - fuel efficiency
  - storage capacity
  - manoeuvrability
  - cost effectiveness
  - range

National Unit Specification: support notes (cont)

UNIT Aeronautical Engineering Fundamentals (SCQF level 6)

2 Investigate aircraft assemblies in relation to aircraft types.

- Identification of main aircraft assemblies: relate assemblies to different aircraft types. Main aircraft assemblies may include:
  - fuselage
  - mainplane
  - fin
  - tailplane
  - powerplant
  - undercarriage
  - aileron
  - elevator
  - rudder
  - main rotor
  - tail rotor

- Description of the primary function of the main aircraft assemblies for different aircraft types

3 State the methods of thrust production and relate these to aircraft types.

- List main methods of aircraft thrust production (Turbo-jet, Turbo-fan, Turbo-prop and Turbo-shaft, Piston) and relate these methods to different aircraft types
- Explain the benefits of the use of particular types of thrust production for different aircraft types. Benefits to include the following:
  - economy
  - power to weight ratio,
  - noise,
  - environmental issues

4 Explain the theory of flight for fixed wing and rotating wing aircraft.

- Comparison of the generation of lift for a fixed wing and rotating wing aircraft to include: pressure distribution around wing, up-wash, down-wash, air viscosity and boundary layer.
- Identification of the forces (Lift, Weight, Drag and Thrust):
  - lift should be identified as acting through the centre of pressure
  - weight through the centre of gravity
  - thrust through the powerplant centreline and
  - drag through the aircraft fuselage centreline
- Identification of aircraft Longitudinal, Transverse and Normal axes. These axes may also be known as Horizontal, Lateral and Vertical or Roll, Pitch and Yaw. Identification of the movement associated with these axes (Roll, Pitch and Yaw).

National Unit Specification: support notes (cont)

UNIT Aeronautical Engineering Fundamentals (SCQF level 6)

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

It is recommended that the Unit is delivered in the same sequence the Outcomes are presented in the National Unit Specification: statement of standards section of this Unit. The Unit may be delivered by a combination of lectures, tutorial work (which may involve some group work), investigations, computer simulations, external visits and practical work. While the majority of the Unit may be delivered in a classroom it is recommended that candidates undertake some investigative work (eg using the Internet, computer simulation software etc.) and practical experimental work (eg experiments involving the use of a wind tunnel etc.) to confirm and reinforce the theory taught in the Unit.

It is recommended that aircraft models, wall charts and DVDs/videos are used extensively to assist learning

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

Although skills in *Communication* are not formally assessed candidates have to demonstrate that they are able to understand and produce complex written and graphic data. Guidance should be provided on the standards required for written responses, which should be accurate, formally expressed and use correct terminology. Supporting graphics should be well presented and clearly annotated. Candidates should be encouraged to research and evaluate technical information from a range of sources including the Internet. Group discussion during formative work will reinforce understanding of Aeronautical Engineering principles and develop oral communication skills in a work related context.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Opportunities for the use of e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by information and communications technology (ICT), such as e-testing or the use of e-portfolios or e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003), SQA Guidelines on e-assessment for Schools (BD2625, June 2005).*

Centres are encouraged to use formative assessment extensively as it plays a particularly important role in allowing candidates to develop a sound knowledge and understanding of aircraft engineering fundamentals including the theory of flight.

The assessment for Outcomes 1, 2 and 3 may comprise of suitable illustrations and a question paper consisting of short answer and restricted response questions, or objective questions (eg multi-choice questions), or a mixture of both. The assessment paper may be delivered online.

Candidate evidence for Outcome 4 may be in the form of a written description of approximately 500 words plus diagrams. It is recommended that centres provide candidates with information and advice on how best to structure their reports.

National Unit Specification: support notes (cont)

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Centres should make every reasonable effort to ensure that the description is the candidate's own work. Where copying or plagiarism is suspected candidates may be interviewed to check their knowledge and understanding of the subject matter. A checklist should be used to record oral evidence of the candidate's knowledge and understanding.

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**