# Module Specification

## Aeronautical Principles

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## Part 1: Information

**Module title:** Aeronautical Principles

**Module code:** UFMEAJ-30-1

**Level:** Level 4

**For implementation from:** 2024-25

**UWE credit rating:** 30

**ECTS credit rating:** 15

**College:** College of Arts, Technology and Environment

**School:** CATE School of Engineering

**Partner institutions:** None

**Field:** Engineering, Design and Mathematics

**Module type:** Module

**Pre-requisites:** None

**Excluded combinations:** None

**Co-requisites:** None

**Continuing professional development:** No

**Professional, statutory or regulatory body requirements:** None

## Part 2: Description

**Overview:** This module introduces apprentices to the fundamental principles of aeronautical engineering. Through traditional lectures and practical sessions with laboratory equipment, apprentices build a strong foundation in aeronautical concepts, preparing them for advanced exploration in higher-level modules.

**Features:** Laboratory activities and use of Wind Tunnel.

**Educational aims:** The aim of this module is to introduce apprentices in the field of aeronautical engineering, the aerospace product life cycle and core aerospace knowledge and principles . The module expands during the second term by introducing apprentices with fundamental concepts in fluid dynamics, thermodynamics and heat transfer for aeronautical scientific methods and applications.
Apprentices will be able to perform laboratory activities and collect data through a variety of equipment. Exposure to data will allow apprentices to analyse test data and apply analytic techniques to understand and evaluate the performance of aerospace products and systems. Apprentices will then have the opportunity to make informed decisions even in situations with incomplete information.

**Outline syllabus:** This module will outline aerospace knowledge such as:

Aerospace Product Life Cycle
Certification process and its security risks
The Atmosphere
Aircraft General Knowledge
Fundamental Principles such as:
- Aerofoils (2D) and wing (3D) analysis
- Aerodynamic forces and moments
- Center of Pressure
Introduction to Engineering Design Process for wings and aircraft
Selecting the most promising solution
Evaluating a prototype through theoretical and practical data
Sampling methods and statistical techniques
Basic Principles of Aircraft Flight Performance
Flight Performance and Planning

Fluid Dynamics:
Conservation principles of mass, momentum and energy including continuity, fluid momentum, Bernoulli’s principle, work, heat and energy.
Hydrostatics.
Incompressible and viscous flow including laminar and turbulent flow.

Flow measurements including measurement systems and uncertainty analysis.
Dimensional Analysis.

Thermodynamics:
Key Concepts and laws of thermodynamics.
Phase Change and Steam.
Non-Flow Energy Equation (NFEE) and Steady Flow Energy Equation (SFEE).
Gas Processes and Gas Laws.
Heat Engines and Thermodynamic Cycles.

It may also include an introduction to heat transfer including conduction, convection, radiation, two-phase heat transfer and heat exchangers.

## Part 3: Teaching and learning methods

**Teaching and learning methods:** This module uses a blend of traditional lectures to introduce and convey concepts and core aeronautical knowledge and principles which are consolidated through tutorials exercises and self-paced sessions. In addition to that, basic familiarisation with an aerofoil simulator is provided, in terms of theoretical data acquisition and comparison with real-life data from experiments.

Students will have the opportunity to further consolidate their learning and apply their knowledge and understanding to a knowledge checker system for fundamental theory of flight, atmosphere and flight phases.

The method of teaching and learning is designed so that students can quickly consolidate theoretical principles through exercises and laboratory experiments.

**Module Learning outcomes:** On successful completion of this module students will achieve the following learning outcomes.

**MO1** Apply the engineering design process to design, manufacture, and evaluate through data analytics, a wing for a given flight mission as part of the

aerospace product life cycle, whilst demonstrating knowledge and understanding of flight phases, performance, and their planning process.

**MO2** Apply mathematical and statistical methods in the visualisation, data analysis and solution of solving problems within aeronautical engineering.

**MO3** Describe and perform basic analysis of thermodynamic cycles related to aeronautical engineering.

**MO4** Accurately assess fluid dynamic flows, their behaviours and evaluate laboratory data with fundamental principles.

**Hours to be allocated:** 300

**Contact hours:**

Independent study/self-guided study = 225 hours

Face-to-face learning = 75 hours

Total = 0

**Reading list:** The reading list for this module can be accessed at readinglists.uwe.ac.uk via the following link https://rl.talis.com/3/uwe/lists/70EF6BF8-1B5E-F3ED-D074-C30508A84BAE.html?lang=en-GB&login=1

## Part 4: Assessment

**Assessment strategy:** The model aircraft design and build activity is communicated and assessed in the form of a group presentation of 30 minutes and provides the control condition assessment. The presentation assesses that apprentices have a clear understanding of the engineering design process and its application to model aircraft design, its wing and build project. The results, data analysis and reflection of the project findings will also be assessed, along with how apprentices made informed decisions even in situations with limited information through an included Q&A as part of the presentation.

Peer review will be included within the assessment in accordance with the departmental group work policy.

An examination assesses that students have a sound understanding of concepts and principles that are required for studies in aerodynamics, aerospace structures and propulsion systems encountered later in the programme.

The resit assessment strategy is the same as the first sit.

Resit deliverable(s) will be scaled appropriately to group size and task complexity

**Assessment tasks:**

**Presentation** (First Sit)
Description: Group presentation of wing design & Q&A (30 minutes)
Weighting: 50 %
Final assessment: No
Group work: Yes
Learning outcomes tested: MO1, MO2

**Examination** (First Sit)
Description: In person exam (2 hours)
Weighting: 50 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO3, MO4

**Presentation** (Resit)
Description: Group presentation of wing design & Q&A (30 minutes)
Weighting: 50 %
Final assessment: No
Group work: Yes
Learning outcomes tested: MO1, MO2

**Examination** (Resit)
Description: In person exam (2 hours)

Weighting: 50 %

Final assessment: Yes

Group work: No

Learning outcomes tested: MO3, MO4

## Part 5: Contributes towards

This module contributes towards the following programmes of study:

Aeronautical Engineering {Apprenticeship-UCW}[UCW] BEng (Hons) 2024-25