## Definitive Module Document (DMD)

Back

Module Info > DMD

**Module Code:**3ACM0011

**Title of Module**
**Full Title:** Aerodynamics
**Short Title:** Aerodynamics

**MODULE**

3ACM0011 (A 05/6)

Aerodynamics...

- Module Homepage
- Module News
- Module Information
- Teaching Resources
- Reading List

**Search Website**

Go

**Version:** 1

**Credit Points:** 15

**Level / ECTS Level:** 3

**First Offered:** 22/9/1997 00-00-00

**6. Home Department:**
AAD

**7. Departments(s) contributing to teaching:**

**9. Module Aims:**

* further develop their ability to analyse the aerodynamics of an aircraft

**10a. Learning Outcomes: Knowledge and Understanding:**

* identify critical issues in the aerodynamic design of an aircraft

**10b. Learning Outcomes: Skills and Attributes:**

* evaluate the relative importance of general flow mechanisms for aircraft aerodynamics

* evaluate the appropriateness of different analytical, experimental and numerical methods

* use Computational Fluid Dynamics (CFD) commercial software and linearised methods to simulate basic flows

* use post-processing software to extract information from complex CFD simulations

**11. Module Content**
**11a Module Content:**
1. Field Theory - An introduction to potential flow analysis

2. Navier-Stokes, Euler and Boundary Layer equations - An introduction to the equations and their area and range of application

3. Transonics and Supersonics - Prandtl-Glauert transformation and linearised theory

4. Hypersonics - Newtonian Theory and Similarity Laws

5. Turbulence and turbulence modelling - Introduction to time averaging of Navier-Stokes and Boundary-Layer equations. Derivation of Reynolds stresses. Introduction to turbulence modelling

6. Introduction to CFD - Introduction to discretisation methods and gridding. Simple solution methods

7. Helicopter aerodynamics - Introduction to rotor aerodynamic

**11b. Further details on how the learning outcomes of the module will be achieved:**
1. Field Theory - Potential flow analysis. Application of methods through examples and tutorials

2. Navier-Stokes, Euler and Boundary Layer equations - Derivation of terms and appreciation of underlying physics. Especial importance is placed on the convective terms. Order of magnitude approach to simplify Navier-Stokes equations. Introduction to different forms of equations. Use of tutorials, examples and course work to reinforce understanding.

3. Transonics and Supersonics - Calculation of critical Mach numbers and introduction to transonic wing design and supercritical sections as well as complete configurations. Evaluation of methods and physical appreciation through tutorials, examples and laboratory experiments.

4.Hypersonics - Introduction to real gas effects and applications of calculation methods to re-entry vehicles through the use of tutorials and examples.

5. Turbulence and turbulence modelling - Introduction to mixing length models and their application. Introduction to inner law variables and the 'law-of-the-wall'. Definition of turbulent kinetic energy and rate of dissipation of turbulence. Introduction to two equation models. Reinforcement of understanding through coursework tutorials and examples.

6.Introduction to CFD - Use of spreadsheets to understand basic numerical methods and introduction to concepts of stability and effects of numerical errors. Introduction to commercial CFD software and commercial post processors. Use of software in tutorials and coursework.

7.Helicopter aerodynamics - Need for blade flapping - simplified blade flapping equation and solutions for symmetric and asymmetric coning. Use of collective and cyclic pitch controls. Descriptive treatment of Helicopter Forward Flight and limitations to forward speed. Tutorials.

**12. Language of Delivery:**
English

**13. Language of Assessment:**
English

**14. Assessment Details (Academic):**
Coursework: 40

Exam: 60

Other: Typically, assessment will consist of-

1 mid course assessment test

1 Computational Fluid Dynamics assignment

1 Transonic/ supersonic laboratory

One 3-hour end-of-course examination

Passes in both (i) coursework and (ii) overall performance are required.

**Assessment Notes:**

**15. Locations(s):**
UH HATFIELD

**16. Pre and Co-Requisite:**
**Pre-Requisite**

**Co-Req**

**Prohibited**

**17. Subject Board of Examiner/s:**
AERO/CIVIL/MECH ENG L2/3

**18. Comments**