MODULE DESCRIPTION FORM

DEPARTMENT OF MECHANICAL AND AEROSPACE ENGINEERING

ME979 Fundamentals of Aeronautical Engineering

Module Registrar: M. Fossati **Marco.fossati@strath.ac.uk**	**Taught To (Course): Cohorts for whom class is compulsory; MSc Advanced Mechanical Engineering with Aerospace**	
Other Lecturers Involved: None	**Credit Weighting: 10 (ECTS 5)**	**Semester: 2 – online**
Compulsory (MSc AME with Aero) / optional class	**Academic Level: 5**	**Suitable for Exchange: N**

Required prerequisites

Note: It is the responsibility of ALL students to ensure that they satisfy the prerequisite knowledge for this module BEFORE adding as part of curriculum selection. If unsure, please contact the Module Registrar or discuss with your Programme/Year Adviser of Studies.

Good programming skills:
Knowledge of basic programming principles:
- manipulation of scalar, vectors and matrix variables;
- use of operators, expressions and statements (including conditional statements);
- algorithms, structured programming logic and flow diagrams;
- computer arithmetic and errors.

Ability to construct flow charts to summarise key steps of a problem.

Ability to develop and implement effective algorithms (MATLAB is the officially supported language/environment for this module, but the coursework can be done in any programming language).

Mathematical methods:
Linear algebra, vectors & matrices.

Numerical Methods:
Solution of linear and nonlinear equations; differentiation and integration; numerical quadrature; interpolation.

Module Format and Delivery (HOURS i.e. 1 credit = 10hrs of study):

Lecture	Tutorial	Laboratory	Groupwork	External	Online	Project	Assignments	Private Study	**Total**
22	38						40		100

Educational Aim

This module is intended for students on the Advanced Mechanical Engineering with Aerospace MSc program who have no prior experience of aerodynamics and flight mechanics It is therefore a “broadening” rather than “deepening” class which is reflected in the wide range of topics covered. It is a distance learning class and has no synchronous lectures or tutorials.

This module introduces students to the principles of aerodynamics and flight mechanics. The aim is to provide students with an understanding of subsonic aircraft aerodynamics and how the stability, control and performance of an aircraft are calculated.

Topics covered include:

- Aerodynamics
- Aircraft design.
- Airworthiness and the flight envelope.
- Aircraft performance

- Static, longitudinal stability and control of aircraft is considered.
- The standard atmosphere – variation of temperature, pressure and density with height is explained.

The calculation of the performance of aircraft is studied: Steady level flight – minimum drag and minimum power flight speed. Steady glide and climb. Take-off and landing. Steady turning flight. Range and endurance. Flight and gust envelopes.

Learning Outcomes

On completion of the module the student is expected to be able to:

LO1 Be able to outline the history of flight

LO2 Investigate the generation of lift, drag.

LO3 Describe how aircraft flight instruments work and how their output may be interpreted.

LO4 Describe bluff body aerodynamics

LO5 Investigate the link between aircraft performance and efficient aerodynamics

LO6 Investigate the effect of the centre of gravity location on the stability and controllability of conventional aircraft.

Syllabus

The module will teach the following:

Sem 1 & 2:

1. History of flight.
2. Theoretical aerodynamics: aircraft layout and nomenclature, lift and drag coefficients, Bernoulli's equation.
3. Generation of lift: aerofoil aerodynamics, boundary layers, stall, and high lift devices.
4. Generation of drag: lift induced, wave, form, skin friction, interference, trim, cooling.
5. Flight instruments: airspeed indicator, indicated and equivalent airspeed, altimeter, rate of climb meter, International Standard Atmosphere.
6. Bluff body aerodynamics: flows past cylinders, spheres and bluff bodies, vortex shedding industrial aerodynamics.
7. Aircraft design process
8. Airworthiness and regulation.
9. Longitudinal static stability and control.
10. Flight performance.

Assessment of Learning Outcomes

Criteria

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

LO1 The history of flight, aircraft propulsion, and spaceflight.
C1 Have a sound knowledge of the history of aviation and be able to discuss this.

LO2 The generation of lift, drag and thrust.
C1 The ability to explain how lift is created and what causes flow separation.
C2 The ability to understand non dimensional numbers in relation to lift drag and Reynolds effects.
C3 The ability to calculate lift and drag forces using lift and drag coefficients.

LO3 Aircraft flight instruments.
C1 The ability to understand how flight instruments work and be able to describe them in detail.
C2 The ability to explain the difference between true, indicated and equivalent airspeed.

LO4 Bluff body aerodynamics
C1 The ability to understand the difference in aerodynamics of streamlined and bluff objects
C2 The ability to understand the effect of Reynolds number on Bluff body aerodynamics
C3 The ability to explain how vortex shedding occurs and the effect it may have on structures.

LO5 Aircraft performance and efficient aerodynamics
C1 Understanding of principles demonstrated through calculations and written descriptions.
C2 Through calculations and written descriptions, demonstrate understanding of how overall performance is affected by design selections – e.g. wing sections and wing configuration.

LO6 Stability and control
C1 Understanding of principles demonstrated through calculations and written descriptions.
C2 Through calculations and written descriptions, demonstrate understanding of how overall stability and control effectiveness is affected by design selections and aircraft configuration.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback
(within Assessment and Feedback Policy at:
*https://www.strath.ac.uk/professionalservices/staff/policies/academic/*http://www.strath.ac.uk/learnteach/informationforstaff/staff/assessfeedback/12principles/*)*

LO1-6 will be assessed by two course work assignments

Informal feedback is provided directly by the use of on-line discussion forums, with self and peer-directed feedback encouraged during the course to the extent that it does not impinge on collaborative working.

Assessment by coursework: students should expect to spend a considerable amount of effort completing these course works as they form an important learning exercise as well as an assessment unit. Written feedback is provided on returned coursework reports.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams *(individual weightings)*

Examination				**Coursework**		**Practical**		**Project**	
Number	Month(s)	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***	Number	***Weighting***
				2	100% (50% each)				
*				*LO1-6		*		*	

* ***L/Os:*** *Indicate which Learning Outcomes (L01, L02, etc) are to be assessed by exam/coursework/practical/project as required.*

Coursework / Submissions deadlines (*academic weeks*): Coursework will be released on Wk 6 and 8. Students should refer to the Myplace page for the relevant submission deadlines

Resit Assessment Procedures:

The resit will consist of an alternative coursework to be submitted prior to commencement of the August exam diet.

^^Students must contact the module Registrar for alternative coursework requirements as soon as results confirm that a resit for this class is required.

PLEASE NOTE:
Students need to gain a summative mark of 50% to pass the module. Students who fail the module at the first attempt will be re-assessed by the August diet. This re-assessment will consist entirely of coursework. No marks from previous attempts will be transferred to new attempts.

Recommended Reading

*****Purchase recommended **Highly recommended reading *For reference**

** "Aircraft Flight" by R H Barnard & D R Philpott, Longman, ISBN 0-582-00338-5
** "Introduction to Flight" by Anderson, McGraw Hill, ISBN 0-07-109282-X

Additional Student Feedback
(Please specify details of when additional feedback will be provided)

Date	Time	Room No
		Check timetable webpages for details

Session: 2023/24

Approved:

Course Director Signature: Olga Ganilova
Date of Last Modifications: 25/08/23

(Updated August 2023)

MODULE TIMETABLE

Module Code:	**ME979**	**Module Title:**	**Fundamentals of Aeronautical Engineering**

Brief Description of Assessment:

2 courseworks (50% each, totalling 100%) - CW1 set in week 6 and to be submitted in week 8, CW2 set in week 8 and to be submitted in week 11.

Assessment Timing:-

Indicate on the table below the start/submission dates for each assignment/project and the timing of each exam/assessment using the dropdowns provided. Dropdowns can be left blank. Add extra notes below the dropdowns.

Please note: Timings can and will change, this should only be used as a guide.

Semester One	W&D Wk	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item.

Semester Two	C&D Wk	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
	None	None	None	None	None	None	Course work Set (CW1)	None	Course work Submit (CW1) // Course work Set (CW2)	None	None	Course work Submit (CW2)	None