

## MODULE SPECIFICATION FORM

Module Title:	<b>Aerodynamics A</b>	Level:	<b>6</b>	Credit Value:	<b>10</b>
---------------	-----------------------	--------	----------	---------------	-----------

Module code: (if known)	<b>ENG680</b>	Cost Centre:	<b>GAAE</b>	JACS2 code:	H440
----------------------------	---------------	--------------	-------------	----------------	------

Semester(s) in which to be offered:	<b>1</b>	With effect from:	<b>July 2015</b>
-------------------------------------	----------	----------------------	------------------

<b>Office use only:</b> To be completed by AQSU:	Date approved:	<b>July 2015</b>
	Date revised:	
	Version No:	<b>1</b>

Existing/New:	<b>New</b>	Title of module being replaced (if any):	N/A
---------------	------------	--	-----

Originating Academic area:	<b>Engineering and Applied Physics</b>	Module Leader:	<b>S Monir</b>
----------------------------	--	----------------	----------------

Module duration (total hours)	100	<b>Status:</b> core/option/elective (identify programme where appropriate):	<b>Free-standing 10-credit component comprising half of ENG619 (Aerodynamics and CFD).</b>
Scheduled learning and teaching hours	36		
Independent study hours	64		
Placement hours	0		

Percentage taught by Subjects other than originating Subject (please name other Subjects):	<b>0%</b>
--	-----------

<b>Programme(s) in which to be offered:</b>	Pre-requisites per programme (between levels):	<b>None</b>
<b>Engineering European Programme (Non Award Bearing)</b>		

### Module Aims:

To analyse the properties of the atmosphere, the effect of forces on the aerodynamic characteristics of aircraft and vehicles, the mechanics of flight and aircraft performance, thus to evaluate design features which provide static and dynamic stability and the forces affecting aircraft stability.

### Expected Learning Outcomes

#### Knowledge and Understanding:

At the completion of this module, the student should be able to:

1. Analyse the properties of air and the atmosphere; calculate the effect of forces on the aerodynamic characteristics of vehicles;
2. Apply the mechanics of airflows to aircraft/vehicle performance; (KS 5)
3. Define those design features which provide static and dynamic stability; solve problems involving forces affecting land vehicle and aircraft stability; (KS 3)

#### Key skills for employability

- |   |  |
|---|--|
| 1. Written, oral and media communication skills,      | 7. Intercultural and sustainability skills   |
| 2. Leadership, team working and networking skills     | 8. Career management skills  |
| 3. Opportunity, creativity and problem solving skills | 9. Learning to learn (managing personal and professional development, self management) |
| 4. Information technology skills and digital literacy | 10. Numeracy   |
| 5. Information management skills                      |  |
| 6. Research skills                                    |  |

**Assessment:** Please indicate the type(s) of assessment (eg examination, oral, coursework, project) and the weighting of each (%).

Assessment is by means of an examination covering all outcomes. It is an unseen time-constrained exam. (This corresponds to the 'examination' element of ENG619.)

Assessment number (use as appropriate)	Learning Outcomes met	Type of assessment	Weighting	Duration (if exam)	Word count (if coursework)
Assessment One:	1, 2, 3	Examination	100%	2 hr	

### Learning and Teaching Strategies:

The aerodynamics will be delivered by a set of structured lectures backed up by tutorials. Laboratory work and computer packages will be utilised where appropriate to aid learning.

### Syllabus outline:

**Properties of the atmosphere:** Properties of atmosphere, Ideal gas law, S.I. units.

**Effect of forces on the aerodynamic characteristics of aircraft and vehicles:**

Forces of importance: thrust, lift and drag. Moments. Centre of Gravity, Centre of Pressure, and Aerodynamic centre. Relationship between these positions.

**Aerodynamic characteristics:** Reynolds number, coefficients, coefficients of lift, drag and moment.

**Mechanics of flight and vehicle performance:**

Flight: Forces involved in climbing flight, gliding flight. Rate of descent and endurance. Criteria for aircraft control in a horizontal turn. Maximum range/endurance conditions for engine types.

Land vehicles: this section can consider aerodynamic forces at different velocities, skids, turns, effects of aerofoils, efficiency, power. Maximum range/endurance conditions for engine types.

**Design features which provide static and dynamic stability:** Static and dynamic stability of aircrafts and vehicles. Functions of parts of the aircraft/vehicle that provide stability. Basic equations of equilibrium for aircraft/vehicles in selected types of motion. Forces and moments used in the analysis of the stability of aircraft/vehicles.

**Forces affecting stability:** Basic equations of equilibrium for an aircraft or land vehicle in selected types of motion. Forces and moments used in the analysis of stability.

### Bibliography:

Essential reading:

Houghton, E.L., et al. (2012) *Aerodynamics for Engineering Students*. 6<sup>th</sup> Edn., Oxford: Butterworth-Heinemann.

Recommended reading:

Anderson, J.D. (2011) *Introduction to Flight*. 7<sup>th</sup> Edn., McGraw-Hill Higher Education

Dingle, L. and Tooley, M. (2012) *Aircraft Engineering Principles*, 2<sup>nd</sup> Edn., Oxford: Butterworth-Heinemann