PRIFYSGOL glyndŵr UNIVERSITY

MODULE SPECIFICATION FORM

Module Title:	**Aerodynamics B**	Level:	**6**	Credit Value:	**10**

Module code: (if known)	**ENG605**	Cost Centre:	**GAAE**	JACS2 code:	**H440**

Semester(s) in which to be offered:	**2**	With effect from:	**July 2015**

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

Existing/New: **Existing**	Title of module being replaced (if any): N/A

Originating Academic area: **Engineering and Applied Physics**	Module Leader: **Z Chen**

Module duration (total hours)	100	**Status:** core/option/elective (identify programme where appropriate):	**Free-standing 10-credit component comprising half of ENG615 (Flight Stability, Control and Compressible Aerodynamics).**
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):	**0%**

Programme(s) in which to be offered: **Enginering European Programme** (Non Award Bearing)	Pre-requisites per programme (between levels):	**None**

Module Aims:

- To extend and develop understanding of the aerodynamic characteristics of a 3D wing from 2D aerofoil in both incompressible and compressible flow regimes;
- To investigate supersonic flow regimes and its effects on bodies and to further develop understanding on the design of basic aircraft sections for supersonic and subsonic flight and on flight vehicle dynamics.

Expected Learning Outcomes

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

1. Display a detailed knowledge of finite wing theory using aerodynamic characteristics from 2D data and critically analyse the supersonic and transonic flow regimes around a body; *(KS 3)*
2. Apply the aerodynamic characteristics of wings with various profiles under various flow regimes (subsonic incompressible, subsonic compressible, transonic, supersonic); *(KS 3)*
3. Use a detailed knowledge of the shapes of various sections of the flight vehicle in order to, with the minimum of guidance, transform given data into novel design solutions for aircraft; *(KS 3)*

Key skills for employability

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

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 one-half (part A) of the examination of ENG615.)

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 module will be delivered by a set of structured lectures backed up by tutorials on material provided in standard notes issued to students on Moodle at the start of the module. Individual study time will be used for the reading of set texts, working on tutorials and private investigations. Relevant video material will be used to strengthen topics from within the module.

Syllabus outline:

Finite Wing Theory: Development of the 2D aerofoil aerodynamics data, Circulation, downwash and upwash effects. Vortices: starting, trailing, bound and horseshoe. Prediction of aerodynamic characteristics of 3D wings from those of 2D aerofoils.

Compressible Flow: Compressible flow regime analysis: subsonic flow at high Mach number, transonic and supersonic. Compressible aerodynamic coefficients: Prandtl-Glaurt correction factor and critical Mach number. Strong and weak shock waves. Lift and drag on supersonic moving aerofoils. Lift and drag in the transonic region.

Supersonic and Subsonic Wing and Body Design: Effect of aerofoil section shape in both supersonic and subsonic flow. The unswept wing and the swept wing (forward and backward) and effects of leading and trailing edges. Example of delta wings. Thin wings and supercritical sections.

Bibliography:

Essential reading:

Houghton, E.L. and Carpenter, P.W. (2006) *Aerodynamics for Engineering Students*, Butterworth-Heinemann.

Recommended reading:

Anderson, J.D. (2011) *Fundamentals of Aerodynamics*, McGraw-Hill.

McCormick, B.W. (2006) *Aerodynamics, Aeronautics and Flight Mechanics*, John Wiley and Son.

Abbot, I.H. and Von Doenhoff, A.E. (1960) *Theory of Wing Sections*, Dover Publications Inc.