Module Descriptor

Title	Aeroelasticity		
Session	2025/26	**Status**	Published
Code	ENGG11049	**SCQF Level**	11
Credit Points	20	**ECTS (European Credit Transfer Scheme)**	10
School	**Computing, Engineering and Physical Sciences**		
Module Co-ordinator	B Rakhshani		

Summary of Module

This module intends to introduce students to the importance of aeroelastic phenomena and their implication on aircraft structural design and analysis. It addresses the level and types of aircraft structures interaction with elastic, inertial and aerodynamic forces. Students are familiarised with issues related to aeroelastic stability and response, concept of flexible aircraft, and static and dynamic aeroelastic problems such as; control reversal, divergence, flutter, and limit cycle oscillations. Also unsteady aerodynamic phenomena such as vortex shedding, and buffeting are discussed in- line with the aeroelastic stability of the aircraft structure. Particular topics to be covered: Structural and aerodynamic stiffness Static aeroelasticity: static divergence of airfoil section/wing, adverse static aeroelastic effects and control reversal and effectiveness Dynamic Aeroelasticity: aerodynamic loads on flexible /oscillating wing, gust response, types of flutter, solutions to flutter problem Aeroelastic design (FSI): use of combined- mathematical model(s) (in the form of simulation package, e.g. CFD-FEA) to solve and model aerodynamic forces interacting with the (aircraft) structures and the structural dynamic response. Experimental Aeroelastic: aeroelastic scaling, flutter test During the course of this module students will develop their UWS Graduate Attributes (https://www.uws.ac.uk/current-students/your-graduate-attributes/); Universal: academic atributes (critical thinking and analytical & inquiring mind); professional attribute (researchmind) Work-Ready: academic attributes (knowledge of aeroelasticity and relevant ICT skills, problem solving). Successful: academic attribute (autonomous); personal attribute (resilient); professional attribute (driven). This module has been reviewed and updated, taking cognisance of the University's Curriculum Framework principles. Examples of this are found within the module such as active and engaging module assessment which reflects industry design activities, learning synergies across modules and levels of study, recorded lecture content supporting students to organise their own study time and the use of real-world practical student generated data with to compare with and validate simulation activity developing digital intelligence meta-skills.

Module Delivery Method	On-Campus[1] ☒	Hybrid[2] ☐	Online[3] ☐	Work -Based Learning[4] ☐
Campuses for Module Delivery	☐ Ayr ☐ Dumfries	☐ Lanarkshire ☐ London ☒ Paisley	☐ Online / Distance Learning ☐ Other (specify)	

Terms for Module Delivery	Term 1	☐	Term 2	☒	Term 3	☐
Long-thin Delivery over more than one Term	Term 1 – Term 2	☐	Term 2 – Term 3	☐	Term 3 – Term 1	☐

Learning Outcomes	
L1	Analyse the impact of aeroelastic effects on aircraft design and performance characteristics.
L2	Analyse and examine the occurrence and effect of flutter, divergence and control reversal on aircraft high-lift systems, and identify and utilise their associated aeroelastic parameters.
L3	Apply analytical, computational and/or experimental method to analyse a practical aeroelastic problem.
L4	N/A
L5	N/A

Employability Skills and Personal Development Planning (PDP) Skills	
SCQF Headings	**During completion of this module, there will be an opportunity to achieve core skills in:**
Knowledge and Understanding (K and U)	**SCQF 11** Demonstrate and work with a broad and integrated knowledge and understanding of the scope, main areas, and boundaries of aircraft aeroelastic performance. A critical understanding of the principal theories, concepts and terminologies. Specific and detailed knowledge and understanding of the application, techniques and practices associated with aeroelastic analysis. Detailed knowledge and understanding of methods and techniques to solve a range of aeroelastic practical problems.

[1] Where contact hours are synchronous/ live and take place fully on campus. Campus-based learning is focused on providing an interactive learning experience supported by a range of digitally-enabled asynchronous learning opportunities including learning materials, resources, and opportunities provided via the virtual learning environment. On-campus contact hours will be clearly articulated to students.

[2] The module includes a combination of synchronous/ live on-campus and online learning events. These will be supported by a range of digitally-enabled asynchronous learning opportunities including learning materials, resources, and opportunities provided via the virtual learning environment. On-campus and online contact hours will be clearly articulated to students.

[3] Where all learning is solely delivered by web-based or internet-based technologies and the participants can engage in all learning activities through these means. All required contact hours will be clearly articulated to students.

[4] Learning activities where the main location for the learning experience is in the workplace. All required contact hours, whether online or on campus, will be clearly articulated to students

Practice: Applied Knowledge and Understanding	**SCQF 11** Apply knowledge and understanding to develop computational and experimental analysis strategies for a certain range of aeroelastic problems. The ability to use a range of specialised skills, techniques/tools, practices and materials to obtain solutions to aeroelastic problems. Apply a range of specialised research outcomes and other techniques to advance understanding of the aeroelasticity phenomena. Plan, develop and use aeroelastic design tool (FSI) to assess aspects of aircraft aeroelastic design requirements. Select and critically evaluate technical literature and other sources of information to solve complex problems Use practical laboratory and workshop skills to investigate complex problems.
Generic Cognitive skills	**SCQF 11** Undertaking, evaluating and assessing aeroelastic performance and design characteristics. Making judgements on appropriate analytical approaches and their findings. Being able to develop conceptual solutions and strategies to complex aeroelastic problems. 4 The ability to practice and critically identify, analyse, conceptualise and define new ideas and concepts and their applications in aircraft aeroelastic design performance. Critically review, consolidate and extend knowledge, skills, practices and thinking in the field of aircraft aeroelasticity. Bringing information together from a variety of sources during problem solving and being able to perceive potential problems with methods and strategies.
Communication, ICT and Numeracy Skills	**SCQF 11** Communicate and using appropriate methods to a range of audience with different levels of knowledge/expertise. Communicate with peers, more senior colleagues and specialists. Use a wide range of ICT applications to support and enhance work level 11 and show critical understanding of the scope and limitations of the tools used and their underlying theoretical basis. Undertake critical evaluations of a wide range of numerical and graphical data with the ability to deal with situations involving missing data and lack of information using research.
Autonomy, Accountability and Working with Others	**SCQF 11** Exercise high level of autonomy and initiative in professional and equivalent activities with the ability to work independently on significant and demanding tasks. Take responsibility for own work and/or significant responsibility for the work of others providing leadership. Take responsibility for a significant range of resources. Demonstrate leadership and/or initiative and make an identifiable contribution to change and development Practise in ways which draw on critical reflection on own and others' roles and responsibilities. Deal with complex ethical and professional issues in engineering context and make informed judgements on issues not addressed by current professional and/or ethical codes or practices.

Prerequisites	**Module Code**	**Module Title**
	Other	
Co-requisites	**Module Code**	**Module Title**

Learning and Teaching

In line with current learning and teaching principles, a 20-credit module includes 200 learning hours, normally including a minimum of 36 contact hours and maximum of 48 contact hours.

Learning Activities During completion of this module, the learning activities undertaken to achieve the module learning outcomes are stated below:	**Student Learning Hours** (Note: Learning hours include both contact hours and hours spent on other learning activities)
Lecture / Core Content Delivery	12
Tutorial / Synchronous Support Activity	24
Independent Study	164
n/a	0
n/a	0
n/a	0
TOTAL	200

Indicative Resources

The following materials form essential underpinning for the module content and ultimately for the learning outcomes:

1) Bisplinghoff, R.L. and Ashley, H. (2013) Principles of Aeroelasticity. 2nd Ed. Dover Publications Inc.

2) Wright, J.R. and Cooper, J.E. (2007). Introduction to Aircraft Aeroelasticity and Loads. Chichester: Wiley–Blackwell.

3) Hodges, D.H. and Pierce, G.A. (2014). Introduction to Structural Dynamics and Aeroelasticity. Cambridge: Cambridge University Press.

4) Megson, T.H.G (2016) Aircraft Structures for Engineering Students. 6th edn. Oxford: Elsevier.

5) MATLAB/SIMULINK Programs or equivalent for Vibration, Flutter and Manoeuvres and Gusts

(N.B. Although reading lists should include current publications, students are advised (particularly for material marked with an asterisk*) to wait until the start of session for confirmation of the most up-to-date material)

Attendance and Engagement Requirements

In line with the Student Attendance and Engagement Procedure, Students are academically engaged if they are regularly attending and participating in timetabled on-campus and online teaching sessions, asynchronous online learning activities, course-related learning resources, and complete assessments and submit these on time.

For the purposes of this module, academic engagement equates to the following:

The School of Computing, Engineering and Physical Sciences considers attendance and engagement to mean a commitment to attending, and engaging in, timetabled sessions. Students will scan their attendance, via the attendance scanners, each time they are on-campus, they will have their attendance recorded in class and they will be expected to login to the VLE several times per week. Students who are unable to attend a timetabled session,

due to illness or other circumstance, should notify their Programme Leader. Across the School an 80% attendance threshold is set. Students who fall below this, will be referred to the Student Success Team to see how they can be best supported in their studies.

Equality and Diversity
The University's Equality, Diversity and Human Rights Procedure can be accessed at the following link: UWS Equality, Diversity and Human Rights Code. Aligned with the University's commitment to equality and diversity, this module supports equality of opportunity for students from all backgrounds and learning needs. Using the VLE, material will be presented electronically in formats that allow flexible access and manipulation of content. This module complies with University regulations and guidance on inclusive learning and teaching practice. This module has laboratory-based teaching and as such you are advised to speak to the Module Co-ordinator to ensure that specialist assistive equipment, support provision and adjustment to assessment practice can be put in place, in accordance with the University's policies and regulations.
(N.B. Every effort will be made by the University to accommodate any equality and diversity issues brought to the attention of the School)

Supplemental Information

Divisional Programme Board	**Engineering Physical Sciences**
Overall Assessment Results	☐ **Pass / Fail** ☒ **Graded**
Module Eligible for Compensation	☐ **Yes** ☒ **No** **If this module is eligible for compensation, there may be cases where compensation is not permitted due to programme accreditation requirements. Please check the associated programme specification for details.**
School Assessment Board	CEPS
Moderator	T Murmu
External Examiner	E Tingas
Accreditation Details	This module is part of the IMechE accredited programmes BEng/Meng (Hons) Aircraft Engineering.
Module Appears in CPD catalogue	☐ **Yes** ☒ **No**
Changes / Version Number	1.13 Module Descriptor copied to 2025/26 template, LO verbs and resources list updatedto reflect ILR feedback, Attendance andEngagement and EDI statements updated

Assessment (also refer to Assessment Outcomes Grids below)
Assessment 1
Unseen Open book examination (70%)
Assessment 2
Coursework (30%)
Assessment 3
N/A

(N.B. (i) Assessment Outcomes Grids for the module (one for each component) can be found below which clearly demonstrate how the learning outcomes of the module will be assessed.

(ii) An indicative schedule listing approximate times within the academic calendar when assessment is likely to feature will be provided within the Student Module Handbook.)

Component 1							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
Unseen Open book examination	☒	☒	☒	☐	☐	70	2

Component 2							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
Coursework	☐	☐	☒	☐	☐	30	0

Component 3							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
N/A	☐	☐	☐	☐	☐		
Combined total for all components						100%	hours

Change Control

What	**When**	**Who**
Module Descriptor copied to 2025/26 template, LO verbs and resources list updatedto reflect ILR feedback, Attendance andEngagement and EDI statements updated	March 2025	B Rakhshani