Module Descriptor

Title	Aircraft Structural Analysis		
Session	2025/26	**Status**	Published
Code	ENGG11048	**SCQF Level**	11
Credit Points	20	**ECTS (European Credit Transfer Scheme)**	10
School	**Computing, Engineering and Physical Sciences**		
Module Co-ordinator	T Leslie		

Summary of Module

As aircraft weight saving opportunities become ever marginalised the design and analysis of an aircraft structure increases in complexity. This compounded by detailed design certification regulations, complex loading regimes, material development, manufacturing advances and challenging operating environments leads to significant challenges for the current aircraft structures engineer. The intent of this module is to develop, from earlier module content, the students' understanding of the regulations, loading, materials and therefore develop analysis techniques including Finite Element Analysis and MATLAB (or equivalent) of the significant aircraft structural components and industry stress analysis scenarios commonly faced. Detailed discussion on the effect the final structural design has on weight, balance, aerodynamics, manufacture, cost, repair in-service, test requirements, service life, decommissioning will be inherent in taught materials and assessment.

Develop critical understanding of aircraft certification specifications in relation to loading, materials and required analysis. Undertake analysis of significant aircraft structural components using analytical, FEA/MATLAB (or equivalent) approaches.

Undertake detailed stress analysis using analytical, FEA/MATLAB (or equivalent) approaches for common industry scenarios, such as cutouts, joints, fasteners, repairs and lugs.

Evaluate the effect the structural design has other functions.

Assessment will be by formal two hour examination and structural analysis design study.

During the course of this module students will develop their UWS Graduate Attributes (https://www.uws.ac.uk/current- students/your-graduate-attributes/) in the following areas-

Universal: Academic - Critical thinking, analytical & inquiring mind; Personal- Ethical; Professional- Research Minded

Work-Ready: Academic - Knowledgeable, Digitally Literate, Problem Solver; Personal - Effective Communicator; Professional - Ambitious

Successful : Academic - Autonomous; Personal - Resilient; Professional- 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	Critically analyse aircraft certification specifications in relation to loading, materials and required analysis.
L2	Undertake structural analysis of significant aircraft structural components using analytical, FEA and/or MATLAB (or equivalent) approaches.
L3	Undertake detailed stress analysis using analytical, FEA and/or MATLAB (or equivalent) approaches for common industry scenarios, cutouts, joints, fasteners, repairs or lugs.
L4	Evaluate the effect the designs produced have on weight, balance, aerodynamics, manufacture, cost, repair in- service, test requirements, service life, decommissioning.
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** A critical knowledge and understanding of advanced mechanics of materials and concepts, and how these relate to aircraft engineering analysis.

[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

	Specific and detailed knowledge and understanding of the application, techniques and practices associated with structural analysis of aircraft engineering design problems. Detailed knowledge of appropriateness of methods and techniques to different problems/scenarios
Practice: Applied Knowledge and Understanding	**SCQF 11** Applying knowledge and understanding to develop modelling and analysis strategies for a wide range of aircraft engineering and design problems, using finite element method techniques. Assessing different strategies with respect to obtaining appropriate efficient solutions to engineering and design problems. Select and apply appropriate computational and analytical techniques to model complex problems, discussing the limitations of the techniques employed. Select and critically evaluate technical literature and other sources of information to solve complex problems. Design solutions for complex problems that evidence some originality and meet a combination of societal, user, business and customer needs as appropriate. This will involve consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards. Apply an integrated or systems approach to the solution of complex problems. Evaluate the environmental and societal impact of solutions to complex problems (to include the entire life-cycle of a product or process) and minimise adverse impacts. Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations.
Generic Cognitive skills	**SCQF 11** SCQF Level 11 Undertaking, evaluating and assessing critical FEA/MATLAB (or equivalent) analysis data. Making judgements on analytical data and results. Being able to develop conceptual solutions and strategies to FE/MATLAB (or equivalent) problems. Dealing with unpredictability in results and making critical comparative assessments between theoretical, simulation, and experimental predictions. 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** Ability to perform, interpret and evaluate complex numerical, geometrical and graphical data and using it to solve problems. Ability to use variables and equations. Ability to integrate existing software with other applications such as spreadsheets/MATLAB (or equivalent). Make use of multi-purpose integrated software systems to solve complex problems. Using communications skills to write detailed, critical technical reports, including text and illustration.

	Using finite element hardware and software and associated ICT equipment and systems such as networks to support and perform a wide range of problem solving tasks.
Autonomy, Accountability and Working with Others	**SCQF 11** Identifying and addressing their own learning needs both during and out with class time. Identifying solution routes and strategies using their own initiative and informed judgements.

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. This module will be delivered via a blend of lectures and tutorial/software laboratory examples of aircraft engineering problems. A range of formative online class exercises will ensure engagement on all topic areas with video recordings of the software for support out of class.	
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: MATLAB (or equivalent) FEA ANSYS APDL/Workbench or equivalent FEA System Donaldson, B.K. (2013) Analysis of Aircraft Structures. 2nd edn. Cambridge: Cambridge Aerospace Series. Megson, T.H.G. (2013) Aircraft Structural Analysis.2nd edn. Oxford: Butterworth-Heinemann.

Niu, M. (1997) Airframe Stress Analysis and Sizing. 2nd edn. Hong Kong: Conmilit Press Limted.

Niu, M. (1999) Airframe Structural Design: Practical Design Information. 2nd edn. Hong Kong: Conmilit Press limited.

(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. Specialist assistive equipment, support provision and adjustment to assessment practice 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	Design
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	1.12 Module Descriptor copied to 2025/26 template, resources list updated to reflect ILR feedback, Attendance and Engagement and EDI statements updated.

Assessment (also refer to Assessment Outcomes Grids below)
Assessment 1
Assessment Category 1: Unseen Open book examination, Weight- 60%.
Assessment 2
Assessment Category 2: Design Study, Weight- 40%.
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	☒	☒	☒	☐	☐	60	2

Component 2							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
Design/ Diagram/ Drawing/ Photograph/	☒	☒	☒	☒	☐	40	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%	2 hours

Change Control

What	When	Who
Module Descriptor copied to 2025/26 template, resources list updated to reflect ILR feedback, Attendance and Engagement and EDI statements updated.	March 2025	T Leslie