University of the West of Scotland

Module Descriptor

Session: 2024/25

Title of Module: Aircraft Structural Analysis			
Code: ENGG11048	**SCQF Level: 11 (Scottish Credit and Qualifications Framework)**	**Credit Points: 20**	**ECTS: 10 (European Credit Transfer Scheme)**
School:	School of Computing Engineering and Physical Sciences		
Module Co-ordinator:	Dr Tony 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					
Face-To-Face	**Blended**	**Fully Online**	**HybridC**	**Hybrid 0**	**Work-Based Learning**
☒	☐	☐	☐	☐	☐
See Guidance Note for details.					

Campus(es) for Module Delivery						
The module will **normally** be offered on the following campuses / or by Distance/Online Learning: (Provided viable student numbers permit) (tick as appropriate)						
Paisley:	Ayr:	Dumfries:	Lanarkshire:	London:	Distance/Online Learning:	Other:
☒	☐	☐	☐	☐	☐	

Term(s) for Module Delivery					
(Provided viable student numbers permit).					
Term 1	☒	Term 2	☐	Term 3	☐

Learning Outcomes: (maximum of 5 statements) At the end of this module the student will be able to:	
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 and lugs.
L4	Evaluate the effect the designs produced have on weight, balance, aerodynamics, manufacture, cost, repair in- service, test requirements, service life, decommissioning.

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 Level **11** A critical knowledge and understanding of advanced mechanics of materials and concepts, and how these relate to aircraft engineering analysis. 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 Level **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 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 Level **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 Level **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.
Pre-requisites:	Before undertaking this module the student should have undertaken the following:

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

*Indicates that module descriptor is not published.

Learning and Teaching	
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. Use of discussion forums will be encouraged. Assessment will be via a coursework utilising FEA and/or MATLAB (or equivalent) software. The module will also be assessed via a two hour final examination covering all learning outcomes.	
Learning Activities During completion of this module, the learning activities undertaken to achieve the module learning outcomes are stated below:	**Student Learning Hours** (Normally totalling 200 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
	Hours Total 200

****Indicative Resources: (eg. Core text, journals, internet access)**

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

Airframe Structural Design, Michael C.Y. NIU Second Edition, 1988, Hong Kong Conmilit Press, ISBN 962-7128-09-0

Airframe Stress Analysis and Sizing, Michael C.Y. NIU Second Edition, 1997, Hong Kong Conmilit Press, ISBN 978- 9627128083

Aircraft Structural Analysis, T.H.G Megson, Second Edition, 2013, Butterworth-Heinemann, ISBN 978-0080982014

Analysis of Aircraft Structures, B.K. Donaldson, Second Edition, 2013, Cambridge Aerospace Series, ISBN 9781107668669 MATLAB (or equivalent) x 30 seats FEA ANSYS APDL/Workbench or equivalent FEA System
(**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.

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.
(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 and Physical Sciences
Assessment Results (Pass/Fail)	Yes ☐No ☒
School Assessment Board	Engineering
Moderator	Tony Murmu
External Examiner	E Tingas
Accreditation Details	This module is part of the IMechE accredited programmes BEng/Meng (Hons) Aircraft Engineering.
Changes/Version Number	1.11 (was 1.10) Module Delivery Changed to Face-To-Face from Hybrid C. Typographical errors corrected in the module summary. Timetabled contact hours for Design study removed.

Assessment: (also refer to Assessment Outcomes Grids below)
Assessment 1 – Unseen Open book examination- 60% of the final mark.
Assessment 2 - A Design Study- 40% of the final mark.
(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.)

Assessment Outcome Grids (See Guidance Note)

Component 1						
Assessment Type (Footnote B.)	**Learning Outcome (1)**	**Learning Outcome (2)**	**Learning Outcome (3)**	**Learning Outcome (4)**	**Weighting (%) of Assessment Element**	**Timetabled Contact Hours**
Unseen open book	✓	✓	✓	✓	60	2

Component 2						
Assessment Type (Footnote B.)	**Learning Outcome (1)**	**Learning Outcome (2)**	**Learning Outcome (3)**	**Learning Outcome (4)**	**Weighting (%) of Assessment Element**	**Timetabled Contact Hours**
Design/ Diagram/ Drawing/ Photograph/	✓	✓	✓	✓	40	0
Combined Total for All Components					**100%**	**2 hours**