University of the West of Scotland

Module Descriptor

Session: 2024/25

Title of Module: Aircraft Design and Performance			
Code: ENGG09027	**SCQF Level: 9 (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 Bassam Rakhshani		

Summary of Module

This module intends to introduce students to the broad but specific overview of the aircraft design and performance configurations and its aerodynamic characteristics. In particular the configuration and sizing of wing design in terms of aerodynamic design requirements is studied and aspects of its geometric shape and features are studied and analysed. The effect of aircraft (wing) design features on aerodynamic forces are studied with computing and analysing critical design and performance parameters.

Aircraft weight and balance characteristics and techniques to estimate weight and CG position are discussed and students are taught on how to conduct weight and CG analysis. Aircraft stability and control performance characteristics are studied where analytical techniques are used to assess and evaluate the state of an aircraft stability mode.

Aircraft performance characteristics in terms of equations of motions, flight mission, flight envelope, and flight phases are studied, and fundamental parameters in flight phase configuration are examined. Limited optimization study to determine and analyse efficient design and/or performance configuration is given throughout the last LO.
Also, students will be introduced to the aspects of aircraft sustainable and green design, such as; low energy consumption and green energy, low emissions, green materials (smart, light weight, recyclability), etc.

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 attributes (critical thinking and analytical & inquiring mind).
Work-Ready: academic attributes (knowledge of aircraft design and performance 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 laboratory and tutorial activity, 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 aircraft design specifications utilising digital solutions supporting assessment authenticity and development of 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	Analyse aircraft wing design configuration and the impact they have on aerodynamic forces.
L2	Analyse and estimate aircraft weight and balance and CG position.
L3	Appraise aircraft performance throughout the operational envelope.
L4	Examine aircraft design and performance configuration layout and optimisation.

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 **9** A critical knowledge and understanding of aerodynamics and aircraft performance and its importance in aircraft design.

	Specific and detailed knowledge and understanding of the application, techniques and practices associated with aerodynamics and aircraft performance. Using aerodynamics calculation tools to solve engineering and design problems.
Practice: Applied Knowledge and Understanding	SCQF Level **9** Applying knowledge and understanding to analyse aerodynamic and aircraft performance problems. Performing wind tunnel testing on aerofoil sections to establish how aircraft wings behave during a typical flight phase. Assessing a wide range of aircraft configurations and deciphering reasons for designing aircraft in this manner from an aerodynamics perspective. 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. Apply an integrated or systems approach to the solution of complex problems. In relation to aircraft design and performance 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.
Generic Cognitive skills	SCQF Level **9** Undertaking, evaluating and assessing analysis of aerodynamics problems. Making judgements on analytical data and results. Being able to develop conceptual solutions and strategies to solve problems. Detailing results data and making critical comparative assessments between theoretical and experimental predictions Bringing information together from a variety of sources during problem solving and being able to explain potential problems with methods and strategies.
Communication, ICT and Numeracy Skills	SCQF Level **9** Ability to perform, interpret and evaluate complex numerical, geometrical and graphical data and using it to solve problems associated with aerodynamics and aircraft performance.

	Ability to derive and solve complex equations. Making use of research literature to find solutions to problems and make use of experimental techniques. Using communications skills to write detailed, critical technical reports, including text and illustration.	
Autonomy, Accountability and Working with others	SCQF Level **9** 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 judgments.	
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	
The learning and teaching activity for this module include lectures, tutorials and problem based learning.	
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
Laboratory	6
Independent Study	158
	Hours Total 200
****Indicative Resources: (eg. Core text, journals, internet access)**	

Access to wind tunnel facilities.

Course notes and presentations will be provided

Anderson, J.D. (1999) Aircraft Performance & Design. McGraw-Hill

Aircraft flight, R.H Barnard and D.R Philpott, Prentice-Hall, 978-0273730989 (ISBN)

The Air Pilot's Manual: The Aeroplane - Technical, Trevor Thom, Airlife, 978-1840371550(ISBN) Aerodynamics for Engineering Students, E.L Houghton, Butterworth-Heinemann, 978-0750651110 (ISBN) Foundations of Aerodynamics, A.Kuethe and C. Chow, John Wiley & Sons, 978-0471129196 (ISBN) Aircraft Performance and Desing, J.D Anderson, McGraw-Hill, 978-0071160100 (ISBN)

Anderson, J.D. (2010) Fundamentals of Aerodynamics. 5th ed. McGraw-Hill

Barnard, R.H and Philpott, D.R. (2009) Aircraft Flight: A Description of the Physical Principles of Aircraft Flight. 4th ed. Prentice-Hall

Federal Aviation Administration (n.d) Aircraft Weight and Balance Handbook, Aviation Supplies & Academics Inc Houghton, E.L. (2003) Aerodynamics for Engineering Students. 5th ed. Butterworth-Heinemann

Kuethe, A. and Chow, C (1997) Foundations of Aerodynamics John Wiley & Sons

(**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	Noorfazreena Kamaruddin
External Examiner	E Tingas
Accreditation Details	This module is part of the IMechE accredited programmes BEng/Meng (Hons) Aircraft Engineering.
Changes/Version Number	2.16 (was 2.15) Module Delivery Changed to Face-To-Face from Hybrid C. Module Moderator changed to Noorfazreena Kamaruddin Assessment changed to Unseen Closed Book Class Test from Unseen Open Book Class Test.

Assessment: (also refer to Assessment Outcomes Grids below)
Assessment 1 - Class test (Unseen Closed Book) (30%)
Assessment 2- Essay (70%)
(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**
Class Test (Unseen Closed Book)	✓		✓	✓	30	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**
Essay	✓	✓	✓	✓	70	
Combined Total for All Components					**100%**	**2 hours**