Module Descriptor

Title	Composite Structures		
Session	2025/26	**Status**	Published
Code	ENGG10021	**SCQF Level**	10
Credit Points	20	**ECTS (European Credit Transfer Scheme)**	10
School	**Computing, Engineering and Physical Sciences**		
Module Co-ordinator	T Leslie		

Summary of Module

This module gives the student an Introduction to composite materials, their classifications, definitions and related terminology. The relationship of composite materials to traditional engineering materials is also outlined. Current and traditional manufacturing and fabrication methods are detailed and discussed as well as discussion of bonding and bolting as fabrication techniques.

Performance characteristics are initially investigated through the use of micromechanical analysis of uni-directional (UD) composites. Elastic mechanical analysis of UD lamina demonstrating the dependence of the properties and proportions of the constituents on the mechanical properties of the lamina. UD lamina strength is then examined in tension and compression and relationship to the properties and proportions of the constituents discussed. Concepts such as fibre pullout will also be addressed.

Structural analysis and lamination theory is then introduced to examine the stress/strain/stiffness behaviour of UD lamina and laminates under multi axial loading. Anisotropic strength and failure theories such as Tsai-Hill will be introduced. The analysis of composites using finite element methods will also be discussed and demonstrated through the use of practical laboratory sessions.

Testing and experimental techniques will also be discussed for establishing and fully characterising the mechanical properties of a composite laminate. Non-destructive testing techniques will be examined and discussed in the relation to the damage tolerance of composite materials especially after impact loading.

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 practical manufacture and testing laboratory, module assessment which reflects industry design activities, learning synergies across modules and levels of study 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 composite materials and their differences to traditional engineering materials.
L2	Appraise and apply the methods of analysis for stress/strain/stiffness of composite materials and structures including computational methods.
L3	Examine design methodologies and current manufacturing methods for composite materials.
L4	Evaluate testing procedures associated with composite materials and structures, including current trends and practices for establishing material properties.
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 10** A critical knowledge and understanding of the use of composite materials and the methods and techniques used when designing with these unique materials. Specific and detailed knowledge and understanding of the application, techniques and practices associated with designing composite

[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

	structures. Using composite materials and structures to solve engineering and design problems. Detailed knowledge of the appropriateness of methods and techniques associated with composite material science and analysis. Critical understanding of the methods used to ascertain and characterise composite materials. Detailed knowledge of 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. Detailed knowledge of quality management systems and their importance to the composites industry.
Practice: Applied Knowledge and Understanding	**SCQF 10** Appling knowledge and understanding to develop analysis and modelling strategies for a wide range of engineering and design problems relating to composite structures. Performing advanced experimental procedure to establish and characterise composite structures. Assessing different strategies with respect to obtaining appropriate efficient solutions to engineering and design problems in composite design. Making use of specialised finite element techniques to solve composite structures 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. Use practical laboratory and workshop skills to investigate complex problems. Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations.
Generic Cognitive skills	**SCQF 10** Undertaking, evaluating and assessing analysis of composite structures problems. Making judgements on analytical data and results. Being able to develop conceptual solutions and strategies to solve problems. Dealing results data 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 10** Ability to perform, interpret and evaluate complex numerical, geometrical and graphical data and using it to solve problems associated with composite design and analysis. Ability to use variables and complex equations. Ability to integrate existing software with into solution processes. Make use of multi-

	purpose integrated software systems to solve complex problems. 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. 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 10** 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. Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion.

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. The learning and teaching for this module comprises a series of lectures, laboratories (practical and software) and tutorials.	
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	18
Tutorial / Synchronous Support Activity	18
Laboratory / Practical Demonstration / Workshop	12
Independent Study	152
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:

Finite Element Analysis System and PC Laboratory with corresponding network facilities and suitable PCs. Software site licences required.

Barbero, J. (2007) Finite Element Analysis of Composite Materials.Boca Raton: CRC Press.

Datoo, M.H. (1991) Mechanics of Fibrous Composites. London: Kulwer Academic Press.

Gay, D. (2007) Composite Materials: Design and Applications. 3rd edn. Dani. Boca Raton: CRC Press.

Hull, D. (1996) An Introduction to Composite Materials. Cambridge: Cambridge University Press.

(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	Design
Moderator	A Uzzaman
External Examiner	M Ghaleeh
Accreditation Details	This module is part of the IMechE accredited programmes BEng/MEng (Hons) Aircraft Engineering and BEng/MEng (Hons) Mechanical Engineering.
Module Appears in CPD catalogue	☐ **Yes** ☒ **No**
Changes / Version Number	2.15 Module Descriptor copied to 2025/26 template, LOs verb and 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: Class Test (Unseen, Closed Book), Weight – 70%
Assessment 2
Assessment Category 2: Essay, Weight - 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 Closed Book (Class Test)	☒	☒	☒	☒	☐	70	2

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

Change Control

What	When	Who
Module Descriptor copied to 2025/26 template, LO verbs and resources list updated to reflect ILR feedback, Attendance and Engagement and EDI statements updated. Unseen closed book class test replaces unseen open book examination.	March 2025	T.Leslie