

University of the West of Scotland

Module Descriptor

Session: 2024/25

Title of Module: Composite Structures			
Code: ENGG10021	SCQF Level: 10 (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			
<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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-</p> <p>Universal: Academic - Critical thinking, analytical & inquiring mind; Personal- Ethical; Professional- Research Minded</p> <p>Work-Ready: Academic - Knowledgeable, Digitally Literate, Problem Solver; Personal - Effective Communicator; Professional - Ambitious</p> <p>Successful : Academic - Autonomous; Personal - Resilient; Professional- Driven</p> <p>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</p>			

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
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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:
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Term(s) for Module Delivery					
(Provided viable student numbers permit).					
Term 1		Term 2		Term 3	
	<input type="checkbox"/>		<input checked="" type="checkbox"/>		<input type="checkbox"/>

Learning Outcomes: (maximum of 5 statements)	
At the end of this module the student will be able to:	
L1	To develop a detailed knowledge and understanding of composite materials and their differences to traditional engineering materials.
L2	To develop knowledge and understanding of the methods of analysis for stress/strain/stiffness of composite materials and structures including computational methods.
L3	To develop knowledge of design methodologies and current manufacturing methods for composite materials.
L4	To develop detailed knowledge of the testing procedures associated with composite materials and structures, including current trends and practices for establishing material properties.

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)	<p>SCQF Level 10</p> <p>A critical knowledge and understanding of the use of composite materials and the methods and techniques used when designing with these unique materials.</p> <p>Specific and detailed knowledge and understanding of the application, techniques and practices associated with designing composite structures. Using composite materials and structures to solve engineering and design problems.</p> <p>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.</p> <p>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.</p> <p>Detailed knowledge of quality management systems and their importance to the composites industry.</p>
Practice: Applied Knowledge and Understanding	<p>SCQF Level 10</p> <p>Applying knowledge and understanding to develop analysis and modelling strategies for a wide range of engineering and design problems relating to composite structures.</p> <p>Performing advanced experimental procedure to establish and characterise composite structures.</p> <p>Assessing different strategies with respect to obtaining appropriate efficient solutions to engineering and design problems in composite design.</p> <p>Making use of specialised finite element techniques to solve composite structures problems.</p> <p>Select and apply appropriate computational and analytical techniques to model complex problems, discussing the limitations of the techniques employed.</p> <p>Select and critically evaluate technical literature and other sources of information to solve complex problems.</p> <p>Use practical laboratory and workshop skills to investigate complex problems.</p>

	Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations.
Generic Cognitive skills	<p>SCQF Level 10</p> <p>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.</p> <p>Dealing results data and making critical comparative assessments between theoretical, simulation, and experimental predictions.</p> <p>Bringing information together from a variety of sources during problem solving and being able to perceive potential problems with methods and strategies.</p>
Communication, ICT and Numeracy Skills	<p>SCQF Level 10</p> <p>Ability to perform, interpret and evaluate complex numerical, geometrical and graphical data and using it to solve problems associated with composite design and analysis.</p> <p>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.</p> <p>Using communications skills to write detailed, critical technical reports, including text and illustration.</p> <p>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.</p>
Autonomy, Accountability and Working with others	<p>SCQF Level 10</p> <p>Identifying and addressing their own learning needs both during and out with class time.</p> <p>Identifying solution routes and strategies using their own initiative and informed judgements.</p> <p>Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion.</p>

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	18
Tutorial/Synchronous Support Activity	18
Laboratory	12
Independent Study	152
	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:	
Finite Element System (Pro/Engineer, Pro/Mechanica, Ansys) + 40 seat PC Lab with corresponding network facilities and suitable PCs. Software site licences required.	
Course notes, presentations and case studies will be provided.	
Text	
Composite Materials: Design and Applications, Daniel Gay, CRC Press, 2007 ISBN : 978-1420045192*	

Finite Element Analysis of Composite Materials, J. Barbero, CRC Press, 2007 ISBN: 978-1420054330* Mechanics of Fibrous Composites, M.H. Dato, Kulwer Academic Press, 1991

ISBN: 978-1851666003*

An Introduction to Composite Materials, D.Hull, Cambridge University Press, 1996, ISBN: 978-0521388559* NAFEMS, How To Analyse Composites, Various, NAFEMS Publications.

(**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 <input type="checkbox"/> No <input checked="" type="checkbox"/>
School Assessment Board	Engineering
Moderator	Asraf Uzzaman
External Examiner	M Ghaleeh
Accreditation Details	This module is part of the IMechE accredited programmes BEng/Meng (Hons) Aircraft and BEng/Meng (Hons) Mechanical Engineering.
Changes/Version Number	2.14 (was 2.13)-

	Module Delivery Changed to Face-To-Face from Hybrid C. Prerequisite modules removed.
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Assessment: (also refer to Assessment Outcomes Grids below)
Coursework 1 – Unseen open book examination (70%)
Coursework 2 – Coursework (30%)
(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	✓	✓	✓	✓	70	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	✓	✓	✓	✓	30	0
Combined Total for All Components					100%	2 hours