Module specification

When printed this becomes an uncontrolled document. Please access the Module Directory for the most up to date version by clicking on the following link: Module directory

Module Code	ENG783
Module Title	Design with Composites-Theory & Practice
Level	7
Credit value	20
Faculty	FAST
HECoS Code	101217
Cost Code	GAME

Programmes in which module to be offered

Programme title	Is the module core or option for this programme
MSc Engineering (Aeronautical) MSc Engineering (Aeronautical) with Advanced Practice MSc Engineering (Mechanical Manufacture) MSc Engineering (Mechanical Manufacture) with Advanced Practice MSc Engineering (Automotive) MSc Engineering (Automotive) with Advanced Practice MSc Engineering (Renewable & Sustainable Energy) MSc Engineering (Renewable & Sustainable Energy) with Advanced Practice MSc Engineering (Management) MSc Engineering (Management) with Advanced Practice	Optional
MSc Composite Materials Engineering MSc Composite Materials Engineering with Advanced Practice	Core
MEng Aeronautical Engineering MEng Automotive Engineering MEng Mechanical Engineering MEng Renewable and Sustainable Engineering	Optional

Pre-requisites

None

Breakdown of module hours

Learning and teaching hours	15 hrs
Placement tutor support	0 hrs
Supervised learning e.g., practical classes, workshops	15 hrs

Learning and teaching hours	15 hrs
Project supervision (level 6 projects and dissertation modules only)	0 hrs
Total active learning and teaching hours	**30** hrs
Placement / work-based learning	0 hrs
Guided independent study	170 hrs
Module duration (total hours)	200 hrs

For office use only	
Initial approval date	22nd Aug 2022
With effect from date	Sept 2022
Date and details of revision	
Version number	1

Module aims

- To cover the detailed mechanics of composites and classical laminate theory
- To apply principles to the choice and design of specific laminate(s).
- To understand the usage of computational methods in aiding the design process.

Module Learning Outcomes - at the end of this module, students will be able to:

In addition to the module learning outcomes, students will also cover the following accreditation of higher education programme (AHEP) fourth edition learning outcomes: **M1, M2, M3,** & **M5**

1	Calculate the mechanical properties of composites based upon classical laminate theory
2	Critically appraise the type of laminate being considered to enable a group of allowables for initial design to be created.
3	Critically evaluate the applications/limitations of computational tools (e.g., finite element) for the analysis of engineering components made from composites materials.

Assessment

Indicative Assessment Tasks:

This section outlines the type of assessment task the student will be expected to complete as part of the module. More details will be made available in the relevant academic year module handbook.

Assessment One: An individual report in which interpretation, specification and implementation of a composite structure is to be analysed through theoretical & computer modelling simulation. Assessment one is a written coursework (5000 words) and represents 100% of the overall mark.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)
1	1-3	Coursework	100%

Derogations

Credits shall be awarded by an assessment board for those Level 7 modules in which an overall mark of at least 50% has been achieved with a minimum mark of 40% in each assessment element.

Learning and Teaching Strategies

The module will be delivered through lectures and seminars and combined with interactive laboratory sessions to enhance students' learning. The learning experience will be further supported by tutorials and self-study work and case studies of industrial significance. This module will also follow the ALF (Active Learning Framework) guidelines, which will include alternative methods of assessment and a blended approach to delivery, with some theory and software sessions being delivered online (depending on requirements and student experience).

Indicative Syllabus Outline

- Basic composites theory for brittle and ductile matrix composites:
    - Analytical theory for effect of volume fraction, failure of composites and effect of loading angle. Main failure criteria max strain, max stress, and the development of quadratic analogue of von-Mises stress for composites, know as the Tsai, Tsai-Hill, and Tsai-Wu criteria.
- Classical laminate theory:
    - Effect of ply orientation, order, symmetry and balance on the characteristics, and strength of the laminate. Optimisation, first ply failure.
    - Introduction to the "Double-Double" concept in laminate design.
    - Assessment of ply mis-alignment error and the effect this has on material properties
- FE and specific dedicated computation programmes for composite design:
    - Introduction to FE analysis using ANSYS ACP, how it works? Limitations and pitfalls (are the answer mesh independent? Locking...) Workflow for generating a model. Worked examples and case-studies.

Indicative Bibliography:

Essential Reads

D. Gay, et al*., Composite materials, design and applications.* London and New York: CRC Press LLC, 2003.

Other indicative reading

T. W. Chou, *Microstructural design of fibre composites,* Cambridge: Cambridge University Press, 2005.

A. Kelly and C. Zweben, *Comprehensive composite materials (volume 6: design and applications).* New York and London: Elsevier Science Ltd, 2000.

AE-27 guidebook, *Design of durable, repairable, and maintainable aircraft composites.* Pennsylvania: Society of Automotive Engineers, Inc, 1997. ISBN: 9780768000207

Journal*. Composite science and technology.* London and New York: Elsevier.

Plus, various others to be signposted on Moodle.

Employability skills – the Glyndŵr Graduate

Each module and programme is designed to cover core Glyndŵr Graduate Attributes with the aim that each Graduate will leave Glyndŵr having achieved key employability skills as part of their study. The following attributes will be covered within this module either through the content or as part of the assessment. The programme is designed to cover all attributes and each module may cover different areas.

Core Attributes
Engaged
Enterprising
Creative
Ethical

Key Attitudes
Commitment
Curiosity
Resilience
Confidence
Adaptability

Practical Skillsets
Digital Fluency
Organisation
Critical Thinking
Communication