Module specification

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Module Code	ENG799
Module Title	Analysis, Testing & QA of Composites
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 Composite Materials Engineering MSc Composite Materials Engineering with Advanced Practice	Core

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
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 introduce the difference in metal and composite testing.
- To introduce the basic mechanical characterisation of composite materials.

- To introduce the appropriate testing standards for data reporting.
- To explain the limitations of the mechanical measurements.
- To introduce the methods for non-destructive characterisations and their limitations.
- To introduce the thermal analysis methods used in the analysis of composites.

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: **M2**

1	Critically evaluate appropriate methods to assess incoming materials and manufactured components and systems.
2	Systematic understanding of the identification of material properties such as glass transition temperature and degree of cure in polymer composites, with conceptual appreciation of the international standard for the characterisation of composite properties.
3	Identify and implement non-destructive testing methods to evaluate the quality of components.

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: A written coursework consisting of case-studies and mini-reports based on the practical industrial issues (e.g., F1 motorsports, Boeing 787 etc.) related to the testing and quality procedures of composites. 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

- Overview of testing and quality control procedures.
- Classical mechanical testing techniques. Use of standard testing methods.
- Specimen preparation: Laminate production, Quality assurance, Strain gauging.
- Quality control for composite manufacture.
- Behaviour of composite materials under different stress modes (tension, compression, shear, flexural and torsional).
- Scaling effects in laminated composites.
- Manufacturing defects from testing.
- Introduction to laminate strength analysis.
- Interlaminar shear, tension also delamination and sub laminate buckling.
- Fatigue characteristics unique to composites (e.g., Tension cracking) and comparison with metallics.
- Types of structural testing (e.g., durability, coupon).
- Coupon tests for allowable damage.
- Full wing testing (fatigue and static).
- Damage tolerance testing.
- Analysis for allowable damage. Knockdown factors.
- Non-destructive evaluation of composite materials and structures
- Brief discussion on environmental testing: Environmental threats to composites. Accelerated environmental testing of composites.
- Innovative composite structural health monitoring techniques, i.e., incorporation of nanostructured materials.

Indicative Bibliography:

Essential Reads

E. J. Barbero, *Introduction to composite materials design.* 3rd edn. Boca Raton: CRC Press, 2017.

M. Noeske, et al., *Adhesive Bonding of Aircraft Composite Structures Non-destructive Testing and Quality Assurance Concepts.* Cham: Springer International Publishing, 2021.

Other indicative reading

A. Kelly and C. Zweben, *Comprehensive composite materials (volume 5: test method, non-destructive evaluation and smart materials).* New York and London: Elsevier Science Ltd, 2000.

M. Subramanian, *Basics of Polymers, Volume One: Testing and Characterization.* New York: Momentum Press, 2018.

J. M. Hodgkinson, *Mechanical testing of advanced fibre composites.* Cambridge and New York: Woodhead Publishing Ltd and CRC Press LLC, 2000.

ASM Handbook, *Non-destructive evaluation and quality control*. volume 17, Ohio: ASM International, 1998.

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