## MODULE DESCRIPTION FORM

**DEPARTMENT OF MECHANICAL AND AEROSPACE ENGINEERING**

# 16565 ENGINEERING COMPOSITES

| | | |
|---|---|---|
| **Module Registrar: Dr Ross Minty** ross.f.minty@strath.ac.uk | **Taught To (Course): Cohorts for whom module is compulsory / optional** | |
| **Other Lecturers Involved:** | **Credit Weighting: 10** | **Semester: 2** |
| **Compulsory / optional module** | **Academic Level: 5** | **Suitable for Exchange: Y** |

### Required prerequisites

**Note: It is the responsibility of ALL students to ensure that they satisfy the prerequisite knowledge for this module BEFORE adding as part of curriculum selection. If unsure, please contact the Module Registrar or discuss with your Programme/Year Adviser of Studies.**

**Ability to work with a spreadsheet and/or MATLAB to aid calculations (MATLAB is the officially supported language/environment for this module, but the assignments and exams can be done in any programming language/software package, including EXCEL).**

**Mathematical methods:** Linear algebra, vectors & matrices.

### Module Format and Delivery (HOURS i.e. 1 credit = 10hrs of study):

| Lecture | Tutorial | Laboratory | Groupwork | External | Online | Project | Assignments | Private Study | **Total** |
|---|---|---|---|---|---|---|---|---|---|
| 20 | 7 | | | | 1.5 | | | 71.5 | 100 |

### Educational Aim

This module aims to give a basic understanding of the fundamental principles behind modern composite materials and an appreciation of predictive modelling and design implications when composites are applied to engineering structures. The main composite manufacturing processes, evaluation and testing will also be outlined, as well as the growing importance of considering sustainability, and circularity when it comes to composite design.

### Learning Outcomes

On completion of the module the student is expected to be able to:

LO1 understand the relationships between the constituents, structure, properties and processing techniques of composites.

LO2 understand micromechanics, classical laminate theory and some of the complexities of laminated systems.

LO3 understand the fundamentals of manufacturing defects, machining and joining, failure mechanisms and damage limitation and repair.

LO4 appreciate sustainability considerations as well as the development and use of SMART composites.

### Syllabus

The module will teach the following:

1. Classification and definition of composites.
2. Fibres and matrices: fibre architecture; thermoplastic and thermosetting matrices.
3. Composite manufacturing: wet lay-up & compression moulding; filament winding & pultrusion; moulding (e.g. resin transfer moulding); pre-preg; choice of manufacturing route.

4. Micromechanics of a ply for weight and stiffness calculations as well as for strength calculation
5. 3D constitutive equations and plane stress constitutive equations of a ply
6. Classical Laminate Theory, ABD matrices and coupling between strain terms
7. Composite failure mechanisms. Impact failure mechanisms & toughening of composites.
8. Manufacturing defects. Machining of composites and joint design. Damage limitation and repair.
9. Characterisation and NDT.
10. SMART composites.
11. Sustainability of composite materials and Life Cycle Assessment.

**Assessment of Learning Outcomes**

**Criteria**
For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

LO1:
C1 Demonstrate an understanding of composite constituents: fibres and matrices, and their properties.
C2 The ability to critically evaluate manufacturing techniques and choose an appropriate manufacturing method.
C3 Assessment of the mechanical performance of composites from the given properties of the constituents.

LO2:
C1 Describe and calculate the response of composite laminae and laminates to external loading via laminate theory involving matrix construction and manipulation.

LO3:
C1 Demonstrate an understanding of manufacturing defects, machining of composites and joining methods.
C2 The ability to critically assess possible failure mechanisms and how failure can be prevented.

LO4:
C1 Describe and explain developments in SMART composites and how sustainability considerations can be addressed.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

**Principles of Assessment and Feedback**
*(within Assessment and Feedback Policy at: https://www.strath.ac.uk/professionalservices/staff/policies/academic/)*

Summative assessments: a) Time constrained quiz (Online Myplace quiz), b) Exam during the April/May exam period

Formal feedback: a) Automatically generated feedback will be provided including the correct answer and a short explanation, and the student's mark will be given for the online quiz, released at a minimum of 72 hours after the quiz deadline. b) Written feedback for the exam will be provided.

Informal feedback: Verbal feedback will be provided to the students during the lectures and tutorial sessions. Additional verbal feedback during the on-campus sessions will be given to support the provided my Myplace quiz feedback.
Written feedback will be given via Myplace forum and email to personal inquiries to the lecturer(s).

**Assessment Method(s) Including Percentage Breakdown and Duration of Exams *(individual weightings)***

| **Examination** | | | | **Coursework** | | **Practical** | | **Project** | |
|---|---|---|---|---|---|---|---|---|---|
| Number | Month(s) | Duration | ***Weighting*** | Number | ***Weighting*** | Number | ***Weighting*** | Number | ***Weighting*** |
| 1 | Apr/May | 2hr | 70% | 1 online quiz (s2 wk7 1.5hr) | 30% | | | | |
| * LO1-LO4 | | | | * | | * | | * | |

* ***L/Os:*** *Indicate which Learning Outcomes (L01, L02, etc) are to be assessed by exam/coursework/practical/project as required.*

**Coursework / Submission deadlines (*academic weeks*):**
Online time constrained quiz in week 7

**Resit Assessment Procedures:**
2hr examination in July/August diet.

**PLEASE NOTE:**
**Students must gain a summative mark of 50% to pass the module. Students who fail the module at the first attempt will be re-assessed during the July/August exam diet. This re-assessment will consist entirely of an exam. No marks from any previous attempts will be transferred to a new resit attempt.**

**Recommended Reading**

*****Purchase recommended **Highly recommended reading *For reference**

**Please refer to the Reading List on Myplace.**

** "An Introduction to Composite Materials" by D Hull & Clyne T.W., Cambridge University Press

**Additional Student Feedback**
*(Please specify details of when additional feedback will be provided)*

| Date | Time | Room No |
|---|---|---|
| | | Check Myplace for details |

Session: 2024/25

**Approved:**

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|---|
| **Programme Lead/Director Signature: Dr A McLaren and Dr G Houston-Scott** |
| **Date of Last Modifications: 02/08/2024** |

(MAE template updated July 2024)

# MODULE TIMETABLE

| **Module Code:** | **16565** | **Module Title:** | **Engineering Composites** |
|---|---|---|---|

**Brief Description of Assessment:**

Examination (70% of overall mark)
1 time-constrained online quiz (shown as 'Online Test' below), duration 1hour 30 minutes (via Myplace; 30% of overall mark), week 7.

## Assessment Timing

Indicated on the table below are the start/submission dates for each assignment/project and the timing of each exam/assessment.

**Please note: Timings could change during unforeseen periods of disruption; this should only be used as a guide.**

| **Semester One** | W&D Wk | WK1 | WK2 | WK3 | WK4 | WK5 | WK6 | WK7 | WK8 | WK9 | WK10 | WK11 | Exam Period |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. |

| **Semester Two** | C&D Wk | WK1 | WK2 | WK3 | WK4 | WK5 | WK6 | WK7 | WK8 | WK9 | WK10 | WK11 | Exam Period |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Online Test | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Choose an item. Choose an item. | Exam |