Prifysgol Wrecsam
Wrexham University

Module specification

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Module Code	ENG7A9
Module Title	Advanced Materials and Manufacturing
Level	Level 7
Credit value	20
Faculty	FACE
HECoS Code	100203
Cost Code	GAME
Pre-requisite module	N/A

Programmes in which module to be offered

Programme title	Core/Optional/Standalone
MSc Engineering (Advanced Manufacturing)	Core

Breakdown of module hours

Learning and teaching hours	18 hrs
Placement tutor support hours	0 hrs
Supervised learning hours e.g. practical classes, workshops	18 hrs
Project supervision hours	0 hrs
Active learning and teaching hours total	**36 hrs**
Placement hours	0 hrs
Guided independent study hours	164 hrs
Module duration (Total hours)	**200 hrs**

Module aims

This module fuses advanced theoretical study with applied experimentation, enabling learners to interrogate, test, and extend current professional and research practice. Through a combination of conceptual exploration and laboratory enquiry, students cultivate critical evaluation, leadership, and evidence-based decision-making skills suitable for professional or doctoral progression.

This module aims to develop knowledge and understanding of advanced materials, composites, and manufacturing technologies, enabling students to evaluate complex engineering problems and select sustainable manufacturing solutions.

Module Learning Outcomes

At the end of this module, students will be able to:

1	Demonstrate detailed knowledge and application of the mathematical theory, principles, and limitations of various conventional, advanced and composite materials (AHEP-4 M2).
2	Critically formulate and analyse advanced and complex composite materials and manufacturing problems using engineering principles, engineering judgement, natural sciences to inform material selection and manufacturing strategy for demanding engineering applications (AHEP-4 M2).
3	Critically evaluate current research literature and technical data and apply methods for determining mechanical properties of advanced engineering materials in various manufacturing situations (AHEP-4 M2).

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 1:

Portfolio

Students will prepare a written portfolio which assesses the capability of knowledge and application of the principles, concepts and limitations of various advanced and composite materials

Assessment number	Learning Outcomes to be met	Type of assessment	Duration/Word Count	Weighting (%)	Alternative assessment, if applicable
1	1-3	Portfolio	4000	100	N/A

Derogations

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

Learning and Teaching Strategies

Learning integrates advanced theoretical study with applied experimentation, enabling students to test and extend current professional and research practice. Face-to-face sessions are complemented by virtual discussions, simulations, and case studies to support analytical depth. Tutorials and supervision focus on independent enquiry, innovation, and leadership in addressing complex challenges.

Welsh Elements

This module will be delivered through the medium of English; however, students have the option to submit their assessments in the medium of Welsh. While this module is not currently offered fully through Welsh, Welsh language support and guidance are available, and some learning materials or tutorial discussions may incorporate Welsh elements where appropriate. To further promote bilingual learning, all students have the opportunity to take the 20-credit Welsh for STEM short course, designed to develop confidence and subject-specific language skills in both English and Welsh.

Indicative Syllabus Outline

- Introduction to advanced and composite materials. Structure-property-processing relationships with respect to strength, modulus, fatigue, toughness, thermal expansion, thermal conductivity, etc.
- Analysis and testing of advanced materials to industry standard. Instrumentation and advanced characterisation techniques for composites. Classification of material properties using A and B basis statistics.
- Polymer Matrix Composites: Fibres, matrices and interfacial/interphasial effects. Manufacturing of Polymer Matrix Composites. Material property formulation, using volume fractions and Classical Laminate Theory
- Metal Matrix Composites: Fibres, matrices and properties. Manufacturing of Metal Matrix Composites.
- Ceramic Matrix Composites: Fibres, matrices and properties. Manufacturing of Ceramic Matrix Composites
- New developments in advanced and composite materials for advanced manufacturing applications.

Indicative Bibliography

Please note the essential reads and other indicative reading are subject to annual review and update.

Essential Reads:

D. R. Askeland and W. J. Wright, Essentials of Materials Science and Engineering, 4th ed. Boston, MA, USA: Cengage Learning, 2018.

Other indicative reading:

M. F. Ashby, H. Shercliff, and D. Cebon, Materials: Engineering, Science, Processing and Design, 4th ed. Kidlington, Oxford, UK: Butterworth-Heinemann, Elsevier, 2019.

G. M. Milton, Theory of Composites. Cambridge, UK: Cambridge University Press, 2002.

ANSYS Granta, ANSYS Granta materials data and selection tools. [Online]. Available: https://www.ansys.com/products/materials

Administrative Information

For office use only	
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