

<b>Module Title:</b>	<b>Composite Materials</b>	<b>Level:</b>	6	<b>Credit Value:</b>	20
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<b>Module code:</b>	ENG691	<b>Is this a new module?</b>	YES	<b>Code of module being replaced:</b>	
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<b>Cost Centre:</b>	GAME	<b>JACS3 code:</b>	J500
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<b>Trimester(s) in which to be offered:</b>	1	<b>With effect from:</b>	September 17
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<b>School:</b>	Applied Science, Computing & Engineering	<b>Module Leader:</b>	N.Luhyna
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Scheduled learning and teaching hours	60 hrs
Guided independent study	140 hrs
Placement	0 hrs
<b>Module duration (total hours)</b>	<b>200 hrs</b>

<b>Programme(s) in which to be offered</b>	Core	Option
BEng (Hons) Composite Design	<input checked="" type="checkbox"/>	<input type="checkbox"/>
BEng (Hons) Mechanical Manufacturing	<input checked="" type="checkbox"/>	<input type="checkbox"/>
BEng (Hons) Applied Product Design	<input checked="" type="checkbox"/>	<input type="checkbox"/>
BEng (Hons) Aeronautical & Mechanical Engineering	<input type="checkbox"/>	<input checked="" type="checkbox"/>
BEng (Hons) Automotive Engineering	<input type="checkbox"/>	<input checked="" type="checkbox"/>

<b>Pre-requisites</b>
None

Office use only

Initial approval February 17

APSC approval of modification Sept 18

5/8/20 Approval of temporary assessment changes for 20-21

22/9/21 Temporary assessment change extended for 21-22

Have any derogations received Academic Board approval?

Version 4

Yes  No

**Module Aims**

- To provide students with a knowledge of the structure, properties, processing and applications of composite materials.
- The module covers polymer, ceramic and metal matrix composites and advanced materials to enable student to apply the knowledge in a wide range of industries.

**Intended Learning Outcomes**

Key skills for employability

- KS1 Written, oral and media communication skills  
 KS2 Leadership, team working and networking skills  
 KS3 Opportunity, creativity and problem solving skills  
 KS4 Information technology skills and digital literacy  
 KS5 Information management skills  
 KS6 Research skills  
 KS7 Intercultural and sustainability skills  
 KS8 Career management skills  
 KS9 Learning to learn (managing personal and professional development, self-management)  
 KS10 Numeracy

At the end of this module, students will be able to		Key Skills	
1	Apply knowledge and demonstrate a systematic understanding of the properties of engineering composite materials.	KS1	KS2
		KS6	KS10
2	Critically evaluate and analyse the most appropriate materials for applications in a range of engineering disciplines.	KS1	KS3
		KS6	
3	Demonstrate the understanding of knowledge and application of the principles, theory of modern engineering materials and methods for determining mechanical properties.	KS1	KS3
		KS10	

**Derogations**

A derogation from regulations has been approved for this programme which means that whilst the pass mark is 40% overall, each element of assessment (where there is more than one assessment) requires a minimum mark of 30%.

**Assessment:**

Assessment One: An individually prepared report of the use of composite materials in a given context.

Assessment Two: A written examination which assesses the capability of knowledge and application of the principles, concepts and limitations of various composite materials.

Post Covid-19 Temporary modification valid for 20/21 and 21/22:

Assessment One: As above

Assessment Two: A written assignment which assesses the capability of knowledge and application of the principles, concepts and limitations of various composite materials

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)	Duration (if exam)	Word count (or equivalent if appropriate)
1	1,2	Coursework	40		2000
2	3	Examination	60	2 hours	
<u>Post Covid-19 Temporary modification valid for 20/21 and 21/22:</u>					
1	1,2	Coursework	40		2000
2	3	Written assignment	60		2000

**Learning and Teaching Strategies:**

The module will be delivered through detailed presentations combined with interactive sessions to enhance students' learning. The learning experience will be further supported by tutorials, practical and self-study work. Practical work will be carried out at the materials laboratory and the composite centre (Advanced Composite Training and Development Centre, Hawarden).

**Syllabus outline:**

**Introduction to composite materials**

Basic definitions, history of composites, classification, definitions and scope of composite materials.

**Composite materials**

Polymer-, metal- and ceramic matrix composites. Reinforcements, matrices and their properties. Areas of application.

**Mechanical performance of composites**

Mechanical properties: strength, creep, fatigue, durability, fracture, toughness, etc. Materials charts and selection. Rule of mixtures, anisotropy, laminates and sandwich structures, stress-strain response.

**Mechanical testing and data generation**

Characterisation techniques, destructive and non-destructive testing, materials characterisation.

**Composite failure mechanisms and prediction**

Basic definitions, failure mechanisms, and ways of predicting a failure.

**Manufacturing processes**

Manufacturing processes for polymer, metal and ceramic based composites. Basic definitions, mould tools, equipment, process control, health and safety, risk assessment.

**Introduction to advanced materials**

Nano-, smart and hybrid composites.

**Composites and environment**

**Bibliography:**

**Essential reading**

Callister, W. (2007) Materials Science and Engineering. John Wiley and Sons. 7th Ed.  
Mitton, G. (2002) Theory of Composites. Cambridge University Press.

**Other indicative reading**

Vasiliev, V. (2013) Advanced Mechanics of Composite Materials and Structural Elements. John Wiley and Sons. 3rd Ed.  
Askeland, D. (2013) Essentials of Materials Science and Engineering. SI Edition. Cengage Learning Ed.  
Ashby, M. (1999) Materials Selection in Mechanical Design. Burlington, Massachusetts: Butterworth-Heinemann. 3rd Ed.