

Module specification

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Module Code	ENG4B4
Module Title	Materials and Environment
Level	4
Credit value	20
Faculty	FAST
HECoS Code	100203
Cost Code	GAME

Programmes in which module to be offered

Programme title	Is the module core or option for this programme
BEng (Hons) Aeronautical and Mechanical Engineering BEng (Hons) Automotive Engineering BEng (Hons) Mechanical Engineering BEng (Hons) Renewable and Sustainable Engineering MEng Aeronautical and Mechanical Engineering MEng Automotive Engineering MEng Mechanical Engineering MEng Renewable and Sustainable Engineering	Core

Pre-requisites

None

Breakdown of module hours

Learning and teaching hours	36 hrs
Placement tutor support	0 hrs
Supervised learning e.g. practical classes, workshops	0 hrs
Project supervision (level 6 projects and dissertation modules only)	0 hrs
Total active learning and teaching hours	36 hrs
Placement / work based learning	0 hrs
Guided independent study	164 hrs
Module duration (total hours)	200 hrs

For office use only	
Initial approval date	22/08/2022
With effect from date	September 2022
Date and details of revision	
Version number	1

Module aims

To support the development of the student in the following areas:

- Different types of materials, their properties and failure types.
- Materials selection by underpinning the key properties of a range of materials.
- Manufacturing and fabrication methods for different materials.
- Environmental and sustainability concerns.

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

1	Identify mechanical and electrical properties of different materials.
2	Analyse and select materials for a particular engineering purpose.
3	Identify environmental challenges in the manufacture and use of materials for particular applications.
4	Choose, when given a product specification, a suitable manufacturing process to meet in terms of quantity, precision, cost, recycling and application environment.

In addition to the module learning outcomes, students will also cover the following accreditation of higher education programme (AHEP) fourth edition learning outcomes: C7 & C13.

Assessment

Indicative Assessment Tasks:

Assessment One: An In-class test (2 hours) on mechanical and electrical properties of different materials, manufacturing processes and environmental issues for some materials. Assessment one is an In-class test and represents 50% of the overall mark.

Assessment Two: A written assignment (2000 words) into materials and manufacturing selection process for a particular product specification. Assessment two is a written assignment and represents 50% of the overall mark.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)
1	1, 2, 3	In-class test	50
2	4	Written Assignment	50

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%.

Learning and Teaching Strategies

The module will be delivered through lectures and seminars and combined with interactive laboratory sessions to enhance students' learning. This module will follow the ALF (Active Learning Framework) guidelines, which will include alternative methods of assessment and a blended approach to delivery (depending on requirements and student experience).

The module is taught through a combination of lectures and workshops. An active and inclusive approach is used to engage learners in the topics and will involve individual, group work and flipped learning experiences aligned to the university's Active Learning Framework (ALF). The approach offers students a flexible and adaptive learning experience that can accommodate a range of options that includes both on campus learning and remote learning where appropriate.

The Moodle VLE and other on-line materials and resources will be available to support learning. ALF offers a balance between the classroom elements and digitally enabled activity incorporating flexible and accessible resources and flexible and accessible feedback to support learning.

Indicative Syllabus Outline

- Types of materials. Natural, metals, ceramics, polymers.
- Introduction to composite materials.
- Type of loadings. Tensile, compressive, shear torsion, bending. Definitions of mechanical properties. Hooke's Law, Young's Modulus, flexural modulus, tensile strength (ultimate and Yield), ductility, hardness, electrical conductivity.
- The basics of failure types. Fatigue, crack propagation, creep.

- Material processing - grain direction, heat treatments, cold working, quenching and annealing, galvanising.
- Metal processing and changes in properties as a result. Rolling, extrusion, pultrusion, castings (different types), die casting, deforming.
- Polymers - thermoplastic and thermosets. Moulding types, blown film, compression moulding. 3D printing materials and their advantages and disadvantages.
- Glasses and ceramics - float glass process, optical quality glass processing, sintering, spinning.
- Production and product related costs. Manufacturing quality control.
- Degradation and life cycle of engineering materials.
- Recycling and the effects on environment.

Indicative Bibliography:

Essential Reads

W. Callister, *Materials Science and Engineering*, 8th ed. Hoboken, N.J.: Wiley, 2011.

Other indicative reading

J. Gere, *Mechanics of Materials*, 8th Ed. Cengage, 2013.

M. F. Ashby, *Materials and design: the art and science of material selection in product design*. Butterworth-Heinemann, 2014.

W. Bolton, *Materials for engineers and technicians*. Routledge, Taylor and Francis, 2015.

M. F. Ashby, *Materials and the environment eco-informed material choice*. Butterworth-Heinemann, 2013.

R. Moore, *Selecting the Right Manufacturing Improvement Tools: What Tool? When?* Butterworth-Heinemann, 2007.

Employability skills – the Glyndwr Graduate

Each module and programme is designed to cover core Glyndwr Graduate Attributes with the aim that each Graduate will leave Glyndwr 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

Creative

Ethical

Key Attitudes

Commitment

Curiosity

Confidence

Adaptability

Practical Skillsets

Digital Fluency

Critical Thinking

Communication