

Module specification

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Refer to the module guidance notes for completion of each section of the specification.

Module code	ENG4AG
Module title	Engineering Materials and Manufacturing
Level	4
Credit value	20
Faculty	FAST
Module Leader	Dr Nataliia Luhyna
HECoS Code	100209
Cost Code	GAME

Programmes in which module to be offered

Programme title	Is the module core or option for this programme
BEng (Hons) Mechatronics Engineering	Core

Pre-requisites

None

Breakdown of module hours

Learning and teaching hours	60 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	0 hrs
Placement / work based learning	0 hrs
Guided independent study	140 hrs
Module duration (total hours)	200 hrs

For office use only	
Initial approval date	24/09/2020
With effect from date	24/02/2020
Date and details of revision	
Version number	1

Module aims

Understanding of different type of materials and how we manufacture with them is key to engineering design. This module introduces materials selection by underpinning the key properties of a range of materials from naturally occurring traditional materials, like such as wood and stone, to modern metallic alloys and ceramics. Once the basic mechanical and electrical properties have been understood, manufacturing and fabrication methods will be introduced. Different manufacturing processes will be discussed with reference to how it changes the mechanical and electrical properties of the base material. Environmental and sustainability concerns will be discussed and analysed alongside failure types and challenges in using some materials.

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

1	Understand electrical and mechanical properties of different materials
2	Select materials for a particular engineering purpose.
3	Provide a fundamental understanding of the manufacturing processes for particular materials and embed quality control processes within the manufacturing design.
4	Identify environmental challenges in the manufacture and use of materials for particular applications.
5	Choose, when given a product specification, a suitable manufacturing process to meet in terms of quantity, precision, cost, recycling and application environment.

Assessment

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.

Indicative Assessment Tasks:

Assessment One, In Class Test – A 2 hour closed book exam that will test the students understanding of mechanical and electrical properties of materials. In addition, there will be questions of the manufacturing processes available for particular materials and how they should be selected.

Assessment Two: An in depth report into the materials and manufacturing selection process for a particular product specification.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)
1	1, 2, 3, 4	Examination	50%
2	5	Report	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

Lectures, guest speakers, tutorial classes, lab sessions and case studies.

Indicative Syllabus Outline

Types of materials, Natural, metallic, Non Metallic, Alloys, Composites.

Ferrous metals and alloys: cast iron, low and high carbon steels, steel alloys (stainless steel), phase diagram, heat treatments.

Non-ferrous metals and alloys: aluminium, copper, lead, zinc alloys (brass and bronze).

Definitions of mechanical properties, Hooke's Law, Young's Modulus, Flexural Modulus, Tensile strength (ultimate and Yield) Ductility, Hardness, Conductivity (thermal and electrical), Diffusivity, Coefficient of Thermal Expansion. Type of stresses, Direct, Principal, Hoop.

The basics of failure types: Factors of safety, Fatigue, crack propagation, creep.

Material Processing: Grain direction, heat treatments, cold working, quenching and annealing, galvanising.

Manufacturing types: Additive/Subtractive, conventional/ nonconventional.

Metal processing and changes in properties as a result – Rolling, extrusion, pultrusion, castings (different types), die-casting, deforming.

Plastics: the distinction between Thermoplastic and Thermosets, moulding types, blown film, compression etc. 3D printing materials and their advantages and disadvantages

Glasses and Ceramics: Float glass process, optical quality glass processing, slumping, coatings.

Basics machining theory: Milling, Speeds, feed, cutting, tapping and deburring.

Production and product related costs: Raw material, purchased items, labour costs, consumable and overheads, make or buy analysis. Manufacturing quality control.

Indicative Bibliography:

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

Essential Reads

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

Other indicative reading

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

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

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

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

Moore, Ron, (2007), Selecting the Right Manufacturing Improvement Tools: What Tool? When?, Butterworth-Heinemann

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. [Click here to read more about the Glyndwr Graduate attributes](#)

Core Attributes

Enterprising
Ethical

Practical Skillsets

Communication