Prifysgol Wrecsam
Wrexham University

Module specification

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Module Code	ENG4AG
Module Title	Engineering Materials and Manufacturing
Level	4
Credit value	20
Faculty	FAST
HECoS Code	100209
Cost Code	GAME
Pre-requisite module	None

Programmes in which module to be offered

Programme title	Core/Optional/Standalone
BEng (Hons) Mechatronics Engineering	Core

Breakdown of module hours

Learning and teaching hours	60 hrs
Placement tutor support hours	0 hrs
Supervised learning hours e.g. practical classes, workshops	0 hrs
Project supervision hours	0 hrs
Active learning and teaching hours total	**0** hrs
Placement hours	0 hrs
Guided independent study hours	140 hrs
Module duration (Total hours)	200 hrs

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	Develop a fundamental understanding of the electrical and mechanical properties of different materials
2	Select materials for a particular engineering purpose.
3	Develop a fundamental understanding of the characters, principles, and key features of key engineering materials and manufacturing processes for some 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

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: 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 2: 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	Duration/Word Count	Weighting (%)	Alternative assessment, if applicable
1	1, 2, 3	Examination	2 hrs	50%	
2	4, 5	Coursework	2000	50%	

Derogations

None

Learning and Teaching Strategies

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

Welsh Elements

Programme is delivered in English and Chinese, however students can submit assessments in Welsh.

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, Youngs Modulus, Flexural Modules, 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 galss 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

Administrative Information

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Initial approval date	24/09/2020
With effect from date	24/09/2020
Date and details of revision	22/07/2025 revalidated, updated template, LO 1 & 2 reworded from understand / provide to develop a fundamental understanding, derogation removed
Version number	2