

Module specification

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Module Code	ENG5A1
Module Title	Materials Engineering
Level	5
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
FdEng Industrial Engineering (Mechanical)	Core
FdEng Industrial Engineering (Manufacturing)	Core

Pre-requisites

N/A

Breakdown of module hours

Learning and teaching hours	30 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	30 hrs
Placement / work based learning	0 hrs
Guided independent study	170 hrs
Module duration (total hours)	200 hrs

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Initial approval date	22/08/2022
With effect from date	September 2022

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Date and details of revision	
Version number	1

Module aims

This module is designed to develop a detailed understanding of the key developments and issues within materials engineering. Post fabrication treatments will be discussed and how these processes influence and affect the material properties. The overall modules aim is to enable students to relate materials choices to product and process design requirements.

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

1	Identify electrical and mechanical properties of different materials and choose appropriate materials for engineering applications
2	Formulate adequate decisions for testing processes, and the choice whether they are destructive or non-destructive methods.
3	Describe and analyses how processes used to manufacture, fabricate and treat materials have an effect on their properties.
4	When given a specification, select a suitable material and process for the task with respect to quality, cost, and sustainability

In addition to the module learning outcomes, students will also cover the following accreditation of higher education programme (AHEP) fourth edition learning outcomes: F7, F4 & F13.

Assessment

Indicative Assessment Tasks:

Assessment One: A written exam (2hrs) covering, but not limited to, Material Selection based on properties, Quality control, non-destructive testing

Assessment Two: An industry led piece of course work where student identifies a material section problem in their workplace (or elsewhere if applicable) and applies critically analyses the problem

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

Derogations

A derogation from regulations has been approved for this module 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 presented to students through a specified series of lectures assisted by notes given to the student at the start of each lecture. Tutorials will be used alongside case studies and discussion sessions to deepen the learning experience. Laboratory sessions will be used to give students a practical knowledge understanding of material properties and how manufacturing method affect the properties.

Indicative Syllabus Outline

- **Types of materials and their application**, Natural, metallic, Non Metallic, Alloys, Composites, future trends
- **Material selection** – Application, Business, manufacturing limitations, applicability, opportunities.
- **Treatment of materials** – Heat treatment, coatings, galvanising
- **Type of Loadings** Tensile, compressive, shear torsion, bending,
- **Definitions of mechanical properties**, Hookes Law, Youngs Modulus, Flexural Modules, Tensile strength (ultimate and Yield) Ductility, Hardness, Conductivity (thermal and electrical), Processing effect on material properties.
- **Failure and environmental issues** – Creep, Fatigue, Thermal degradation, corrosion, 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), diecasting, 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.
- **Non-destructive testing** – Methods and their applications, implementation in quality control, inspection intervals.

Indicative Bibliography:

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

Essential Reads

W. D. Callister and D. G. Rethwisch, D. G. *Fundamentals of materials science and engineering : an integrated approach*. 5th edition. New Jersey: John Wiley & Sons, Inc, 2016.

Other indicative reading

M. F. Ashby, *Materials and the environment*. London: Elsevier, 2012.

M. F. Ashby, et al., *Materials: Engineering, Science, Processing and Design*. 4th ed. Oxford: Butterworth-Heinemann, 2018.

W. Bolton, *Materials for Engineers and Technicians*. 6th ed. London: Routledge, 2015.

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.

Core Attributes

Engaged
Enterprising
Creative
Ethical

Key Attitudes

Commitment
Curiosity
Resilience
Confidence
Adaptability

Practical Skillsets

Digital Fluency
Organisation
Leadership and Team working
Critical Thinking
Emotional Intelligence
Communication