# Module specification

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

| | |
|---|---|
| Module Code | ENG5AF |
| Module Title | Materials and Processes |
| Level | 5 |
| Credit value | 20 |
| Faculty | FAST |
| 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) Industrial Engineering Design (Mechanical) | Core |
| BEng (Hons) Production Engineering | Core |

## Pre-requisites

*None*

## 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 |

| For office use only | |
|---|---|
| Initial approval date | 11/09/2019 |
| With effect from date | Sept 2019 |
| Date and details of revision | Jan 2020: admin update of derogation<br>Sept 2022: template update and addition of AHEP4 LOs |
| Version number | 3 |

## Module aims

This module is designed to develop a detailed understanding of the uses and limitations of common engineering materials and processes. Surface and material treatments will be discussed and how these processes change the base material property. 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 | Demonstrate an understanding of electrical and mechanical properties of different materials and select appropriate material for engineering applications |
| 2 | Analyse the performances of quality control of materials and Non Destructive Testing methodologies. |
| 3 | Evaluate how manufacturing processes and have an effect on material properties. |
| 4 | Analyse, 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: C4 & C13.

## 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 One: A written exam (2 hour) 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. (indicative word count: 2000 words)

| 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. Material labs will 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 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.

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. Please *ensure correct referencing format is being followed as per University Harvard Referencing Guidance.*

**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
Communication