

Module Code:	ENG5AF
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Module Title:	Materials and Processes
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Level:	5	Credit Value:	20
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Cost Centre(s):	GAME	JACS3 code:	H700
		HECoS code:	100209

Faculty	FAST	Module Leader:	M Jones
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Scheduled learning and teaching hours	30 hrs
Guided independent study	170 hrs
Placement	0 hrs
Module duration (total hours)	200 hrs

Programme(s) in which to be offered (not including exit awards)	Core	Option
BEng (Hons) Industrial Engineering Design (Mechanical)	✓	<input type="checkbox"/>
BEng (Hons) Production Engineering	✓	<input type="checkbox"/>

Pre-requisites
None

Office use only

Initial approval:11/09/19

Version no:1

With effect from:11/09/19

Date and details of revision:

Version no:4

30/01/20 Admin update of derogation

12/8/20 Temporary change to assessment for 2020/21 post Covid.

22/9/21 Temporary changes to assessment extended for 21/22

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.

Intended Learning Outcomes

Key skills for employability

- KS1 Written, oral and media communication skills
- KS2 Leadership, team working and networking skills
- KS3 Opportunity, creativity and problem solving skills
- KS4 Information technology skills and digital literacy
- KS5 Information management skills
- KS6 Research skills
- KS7 Intercultural and sustainability skills
- KS8 Career management skills
- KS9 Learning to learn (managing personal and professional development, self-management)
- KS10 Numeracy

At the end of this module, students will be able to**Key Skills**

At the end of this module, students will be able to		Key Skills	
1	Demonstrate an understanding of electrical and mechanical properties of different materials and select appropriate material for engineering applications	KS1	KS2
		KS3	KS9
		KS5	
2	Analyse the performances of quality control of materials and Non Destructive Testing methodologies.	KS7	KS3
		KS6	
3	Evaluate how manufacturing processes and have an effect on material properties.	KS1	KS8
		KS5	
4	Aanalyse, when given a product specification, a suitable manufacturing process to meet in terms of quantity, precision, cost, recycling and application environment.	KS4	KS5
		KS6	KS10

Transferable skills and other attributes

Communication skills
 Decision making
 Evaluation and analysis skills
 Networking
 Research skills
 Time Management skills
 Reflective practice skills

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%.

Assessment:

Indicative Assessment Tasks:

Assessment One: A written exam 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

Post Covid-19 Temporary modification valid for 20/21 and 21/22:

Assessment One: A written assignment covering, but not limited to, Material Selection based on properties, Quality control, non-destructive testing.

Assessment Two: As above.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)	Duration or Word count (or equivalent if
1	1, 2, 3	Examination	50	2Hrs
2	4	Coursework	50	2500
<u>Post Covid-19 Temporary modification valid for 20/21 and 21/22:</u>				
1	1, 2, 3	Written Assignment	50	2000
2	4	Coursework	50	2500

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.

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:**Essential reading**

Callister, W.F. (2015) Fundamentals of materials science and engineering, 9th Edn., Oxford:

Other indicative reading

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

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

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