

ES1A9-15 Materials and Manufacturing Processes

22/23

Department

School of Engineering

Level

Undergraduate Level 1

Module leader

Antonia Betzou

Credit value

15

Module duration

24 weeks

Assessment

100% coursework

Study locations

University of Warwick main campus, Coventry Primary

Distance or Online Delivery

Description

Introductory description

In any engineering activity the performance of materials needs to be understood to ensure that the processes of design and manufacture can consistently deliver new products to the market in a controlled and safe manner. Today, with more and more environmental legislation and greater and greater competition, the engineer is tasked with using less and less materials, which in turn means they have to be proportionately more reliable and their properties even better controlled. Many aspects affect material properties. At the most basic level the arrangement of the individual atoms within the structure is important. The next level of importance is due to the in homogeneous nature of materials.

Module aims

This module will outline the main materials and processes used to manufacture products. Students need to understand the relationship between mechanical, electrical and environmental properties of these materials, the processes and product design. The module will cover the main classes of metals, polymers, ceramics, electronic materials and composites with an emphasis on understanding structure property relationships and the resulting constraints on manufacturing

process and environmental regulations. The module will cover the main primary (shaping and joining) processes as well as some secondary manufacturing processes used in the design and creation of commercial products from these materials.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Processes for metallic and polymeric materials, 3D printing and rapid prototyping, Thermal treatments and coatings.

Bulk materials. Engineered materials, Fabricated products. Servicing of Products.

Recycling/disposal. Materials cycle focusing on electro-mechanical aspects, Properties of materials: mechanical; electrical; environmental; dielectric; magnetic; optical; manufacturing; thermal; electrochemistry-electrolysis, corrosion and its prevention, Nature and family of materials: metallic, ceramics, polymers, composites, electronic materials, Atomic structure, Use Granta Edupack CES

Learning outcomes

By the end of the module, students should be able to:

- Explain the nature of materials, information and systems and be able to select appropriate materials for engineering use.
- Explain the main classes of engineering materials, properties, and structures.
- Describe and select appropriate manufacturing processes and materials for simple products, recognising limitations including sustainability issues.
- Describe how structures of materials can be manipulated to enhance the properties of materials.
- Describe the purpose and benefits provided by thermal treatments including the associated processes.

Indicative reading list

- Manufacturing Processes for Engineering Materials. Kalpakjian and Schmid
- Manufacturing Engineering Technology: Kalpakjian and Schmid
- Materials Science for Engineers, James F Shackelford. ISBN 0-13-127619-0
- Callister W.D., Materials Science and Engineering
- Ashby, M.F, Materials Selection in Mechanical Design
- Askeland, D.R. The science of engineering materials

[View reading list on Talis Aspire](#)

Subject specific skills

Plan and record self-learning and development as the foundation for lifelong learning- Domain knowledge

Common methods and models for manufacturing processes-

Communicate effectively with technical and non-technical audiences -Interpreting phase diagrams, isothermal transformation diagrams, stress-strain curves
Calculating composite stiffnesses and densities using theory of composites
Developing Performance Indices for Materials Selection
Follow a methodical approach to engineering problem solving- Materials selection processes
Granta Edupack software

Transferable skills

- Respect the environment and the public good. Consider sustainability and the adverse effects of projects and tasks on the wider world, in the short and longer term. Technical writing part of coursework that requires discussion on the environmental impact of manufacturing processes. Communicational technical writing skills.
- Communicate confidently to create and maintain working relationships. Be respectful. Work collaboratively as a team player. Able to work effectively within a team and interact with /help others when required.
Hold paramount the health and safety of themselves and others, and model health and safety conscious behaviour-Team working in practical exercises
- Prioritise quality. Follow rules, procedures and principles in ensuring work completed is fit for purpose, and pay attention to detail / error checks throughout activities. Leadership in group activities during lectures

Study

Study time

Type	Required
Lectures	18 sessions of 1 hour (12%)
Seminars	9 sessions of 1 hour (6%)
Tutorials	(0%)
Practical classes	3 sessions of 1 hour (2%)
Work-based learning	90 sessions of 1 hour (60%)
Online learning (scheduled sessions)	(0%)
Online learning (independent)	(0%)
Private study	30 hours (20%)
Total	150 hours

Private study description

30 hours guided independent learning (including VLE use).
Review of content, practice using voluntary online Moodle quizzes. Reading using online textbooks.

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group A

	Weighting	Study time
Coursework	100%	
The students need to pick a product from their workplace (if this is possible) and prepare a record card including details about the manufacturing process. The second task for students is to prepare a case study for the manufacturing process of the specific product, including a detailed material selection based on the tools provided by CES Granta Edupack, and discussion about every step of manufacturing (sustainability, materials, environmental impact).		

Feedback on assessment

Written individual feedback on all individual assessments.

Availability

Pre-requisites

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Courses

This module is Core for:

- Year 2 of DESA-H360 Undergraduate Electromechanical Engineering (Degree Apprenticeship)