

# WM171-15 Materials and Manufacturing Processes

**22/23**

**Department**

WMG

**Level**

Undergraduate Level 1

**Module leader**

Antonia Betzou

**Credit value**

15

**Module duration**

3 weeks

**Assessment**

40% coursework, 60% exam

**Study locations**

University of Warwick main campus, Coventry Primary

Distance or Online Delivery

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## Description

### Introductory description

In any engineering activity the performance of materials needs to be understood to ensure that the processes of design and manufacturing can consistently deliver new products to the market.

Today, with increasing environmental legislation and greater competition, the engineer is tasked with using novel 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. Other factors include the effects of inhomogeneities that are caused by the manufacturing processes used to form the material into the component's shape.

[Module web page](#)

### Module aims

This module will outline the main materials and processes used to manufacture products and will align as closely as possible with aspects of the DFMA module. Students need to understand the relationship between the 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. 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.

Bulk materials. Engineered materials. Fabricated products. Servicing of products.  
Recycling/disposal. The materials cycle relates directly to all streams of engineering and examples from civil, electronic and mechanical/manufacturing will be used for each area.

Nature and family of materials with an emphasis on understanding the structure/property relationship.

Metallic. Ceramics. Polymers. Composites. Electronic materials.

Atomic structure. Molecular structure and bonding. Structure of solid materials. Crystal systems. Crystal imperfections. Substitutional solid solutions. Interstitial solid solutions.  
Properties of materials: Mechanical properties. Electrical properties. Dielectric properties. Magnetic properties. Optical properties. Manufacturing properties. Thermal properties.  
Electrochemistry- electrolysis, corrosion and its prevention. Testing standards.

## **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, whilst considering sustainability.
- Explain and be able to describe how to exploit the structure property relationship in order to enhance the utility of engineering materials in use and in manufacture
- Appreciate the available range and limitations of manufacturing processes and sustainability and propose suitable processes for simple products
- Appreciate the basic concepts and the terminology of materials science as applied in all major branches of engineering so that they are sufficiently able to hold discussions with specialists in a multi-disciplinary team
- Describe the purpose and benefits provided by thermal treatments including the associated processes.

## **Indicative reading list**

- Manufacturing Processes for Engineering Materials. Kalpakjian and Schmid ISBN 9789810679538
- Manufacturing Engineering Technology: Kalpakjian and Schmid ISBN 9789810694067
- Materials Science for Engineers, James F Shackelford. ISBN 0-13-127619-0
- Callister W.D., Materials Science and Engineering ISBN 9781119453918

- Ashby, M.F, Materials Selection in Mechanical Design ISBN 9780081005996
- Askeland, D.R. The science of engineering materials ISBN 9781305077102
- Principles of Modern Manufacturing - Materials Processed and Systems, MikellP. Groover ISBN 978-1-119-24912-2

[View reading list on Talis Aspire](#)

## Subject specific skills

Domain knowledge

Interpreting phase diagrams, isothermal transformation diagrams, stress-strain curves

Calculating composite stiffnesses and densities using theory of composites

Developing Performance Indices for Materials Selection

Materials selection processes

Granta Edupack software

## Transferable skills

Technical writing

Communication

Team working

Leadership

## Study

### Study time

| Type                                 | Required                    |
|--------------------------------------|-----------------------------|
| Lectures                             | 7 sessions of 3 hours (14%) |
| Seminars                             | (0%)                        |
| Tutorials                            | 6 sessions of 1 hour (4%)   |
| Practical classes                    | 1 session of 3 hours (2%)   |
| Online learning (scheduled sessions) | 6 sessions of 1 hour (4%)   |
| Online learning (independent)        | 2 sessions of 1 hour (1%)   |
| Other activity                       | 10 hours (7%)               |
| Private study                        | 42 hours (28%)              |
| Assessment                           | 60 hours (40%)              |
| Total                                | 150 hours                   |

### Private study description

Review of content, practice using voluntary online Moodle quizzes. Research using online

textbooks.

## Other activity description

Distance learning support

## Costs

No further costs have been identified for this module.

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## Assessment

You must pass all assessment components to pass the module.

### Assessment group D

|   | Weighting | Study time | Eligible for self-certification |
|---|-----------|------------|---------------------------------|
| MMP Coursework  | 40%       | 24 hours   | Yes (extension)                 |
| The learners need to write a lab report discussing the experimental results. The lab is an Impact Toughness lab, and during it they need to test different materials at different temperatures and discuss the effect of temperature on properties. |           |            |                                 |
| MMP Exam  | 60%       | 36 hours   | No                              |
| Online examination (2 hrs) will be conducted to cover the appropriate learning outcomes.  |           |            |                                 |

### Feedback on assessment

Written individual feedback on all individual assessments.  
Cohort feedback for the exam.

[Past exam papers for WM171](#)

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## Availability

### Pre-requisites

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## Courses

This module is Core for:

- Year 1 of UWMS-H7C3 Undergraduate Applied Professional Engineering (Control/Technical Support Engineer)
- Year 1 of DWMS-H7C7 Undergraduate Applied Professional Engineering (Control/Technical Support Engineer) (Degree Apprenticeship)
- Year 1 of UWMS-H7C2 Undergraduate Applied Professional Engineering (Electrical/Electronic Support Engineer)
- Year 1 of DWMS-H7C6 Undergraduate Applied Professional Engineering (Electrical/Electronic Support Engineer) (Degree Apprenticeship)
- Year 1 of UWMS-H7C1 Undergraduate Applied Professional Engineering (Manufacturing Engineer)
- Year 1 of DWMS-H7C5 Undergraduate Applied Professional Engineering (Manufacturing Engineer) (Degree Apprenticeship)
- Year 1 of UWMS-H7C4 Undergraduate Applied Professional Engineering (Product Design and Development Engineer)
- Year 1 of DWMS-H7C8 Undergraduate Applied Professional Engineering (Product Design and Development Engineer) (Degree Apprenticeship)