WM171-15 Materials and Manufacturing Processes

21/22

Department
WMG
Level
Undergraduate Level 1
Module leader
Antonia Betzou
Credit value
15
Module duration
13 weeks
Assessment
50% coursework, 50% exam
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 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 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: Kalpajian 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 tranformation 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	4 sessions of 1 hour (3%)
Seminars	(0%)
Tutorials	6 sessions of 1 hour (4%)
Practical classes	1 session of 3 hours (2%)
Online learning (scheduled sessions)	20 sessions of 1 hour (13%)
Online learning (independent)	5 sessions of 1 hour (3%)
Other activity	10 hours (7%)
Private study	62 hours (41%)
Assessment	40 hours (27%)
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.

Assessment

You must pass all assessment components to pass the module.

Assessment group C

	Weighting	Study time	Eligible for self-certification
MMP Coursework	50%	20 hours	Yes (extension)
The students need to develop a poster presentation that defines the experimental process based on the lab that have to attend. The lab is an Impact Toughness lab, and during it they need to test different materials. They then need to write a short report discussing their experimental results and propose their material selection for the question given.			
MMP Exam	50%	20 hours	No
Online examination (1.5 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

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)