WM171-15 Materials and Manufacturing Processes

26/27

Department
WMG
Level
Undergraduate Level 1
Module leader
Antonia Betzou
Credit value
15
Module duration
14 weeks
Assessment
Multiple
Study locations
University of Warwick main campus, Coventry Primary
Distance or Online Delivery

Description

Introductory description

This module provides the fundamental knowledge in materials science and manufacturing, relevant to Degree Apprenticeship Standards ST0023, ST0024, ST0025 and ST0027.
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. Therefore, this module focuses on Structure-Property Relationship.

This module is linked with C1, AHEP C2, AHEP C3, AHEP C4, AHEP C12, AHEP C13 and AHEP C16 of the AHEP 4.

LO 1 - C1, C4, C13
LO2 - C1, C4
LO3 - C1, C4
LO4 - C1, C2, C4

LO5 - C1, C2, C4, C12, C13, C16
LO6 - C1 ,C2, C4, C13

Module web page

Module aims

This module aims are focused on the ability of students to outline the main materials and processes used to manufacture products and will align as closely as possible with aspects of Engineering Design module. Apprentices need to understand the relationship between the structural properties of these materials, the processes and product design with an emphasis on understanding structure property relationships and the resulting constraints on manufacturing process. Furthermore, to cover traditional 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.

- Atomic structure. Molecular structure and bonding. Structure of solid materials. Crystal systems. Crystal imperfections. Substitutional solid solutions. Interstitial solid solutions. Structure/Properties relationship
- Thermal Treatments and Strengthening mechanisms.
- Properties of materials: Mechanical Electrical Magnetic Physical properties.
- Testing Standards.
- Metallic. Ceramics. Polymers. Composites. Electronic materials.
- Bulk materials. Engineered materials. Fabricated products. Servicing of products. Recycling/disposal. Manufacturing Technologies.
- Material Selection using Granta Edupack.

Learning outcomes

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

- Summarise the basic concepts and the terminology of materials science so that the students are able to work in a multi-disciplinary team. [AHEP:4-C1, C4]
- Interpret the structure-property relationship and how it relates to the utility of engineering materials in use and in manufacture. [AHEP:4- C1, C4]
- Describe simple theoretical models to predict mechanical behaviour and basic failure mechanisms of engineering materials. [AHEP:4- C1, C2, C4]
- Working as part of a team or as an individual, demonstrate the basic concepts of mechanical behaviour and failure mechanisms through experiment, producing a technical report. [AHEP:4- C1, C2, C4, C12, C13, C16]
- Apply basic mechanical theory, knowledge of structure-property relationship and manufacturing processes to conduct a materials selection process with CAE tool with consideration of economic and environmental drivers linking with Engineering Design

Process. [AHEP:4- C1 ,C2, C4, C7, C13]

Indicative reading list

Reading lists can be found in Talis

Specific reading list for the module

Subject specific skills

-Select, use and apply approved problem-solving methods to solve complex problems and determine appropriate solutions or actions (S2 in all DA standards).

- Select the best method for collating and conveying complex information using a range of data sources and supporting documentation (S3 in all DA standards).
- Comply with statutory and organisational safety standards and requirements, supporting safety risk assessments and mitigate any risks (S7 in ST0023, S7 in ST0027 and S8 in ST0024 and ST0025)
- Collate and use a range of data sources and supporting documentation to support projects (S3 in ST0027)
- Observe, record and draw accurate and auditable conclusions from data and/or developmental or test evidence (S3 in ST0027, S5 in ST0023, ST0024, ST0025)
- Ensure that all systems and/or equipment has been correctly configured and checked for safe operation before use (S12 in ST0027, S11 in ST0023, S13 in ST0024 and ST0025)
- Interpret and produce technical documentation such as schematic and circuit diagrams, engineering drawings or 3D CAD models, simulation models, project plans, engineering reports, test reports, fault reports or data analytics using company documentation systems and guidelines (S4 in ST0027).

Transferable skills

- Critical Thinking: Recognise patterns, themes and key messages from sometimes confused and incomplete data; Make informed decisions on the value of a range of sources allowing an evidence based conclusion based on this analysis.
- Organisational awareness: Understanding organisational norms of behaviour.
- Information literacy: The systematic collection, analysis and evaluation of information in the investigation of a topic.
- Professionalism: Manages priorities and time.
- Self-awareness: Aware of personal strengths and emotional intelligence; Reflect on learning, seeking feedback on and evaluating personal practices, strengths and opportunities for personal growth.
- Teamwork: Operate within, and contribute to, a respectful, supportive and cooperative group climate.
- Problem solving: Use rational and logical reasoning to deduce appropriate and well-reasoned conclusions.
- Communication: Written: Present arguments, knowledge and ideas, in a range of formats.

Study

Study time

Type	Required
Lectures	6 sessions of 1 hour (4%)
Tutorials	6 sessions of 1 hour (4%)
Practical classes	3 sessions of 1 hour (2%)
Online learning (scheduled sessions)	15 sessions of 1 hour (10%)
Online learning (independent)	10 sessions of 1 hour (7%)
Other activity	5 hours (3%)
Private study	45 hours (30%)
Assessment	60 hours (40%)
Total	150 hours

Private study description

Review of content, practice for online Moodle quizzes.

Online forum and discussion (asynchronous).

Other activity description

Online support / consultancy for the assignment and for the exam.

Details of on-line (independent):
5 hours of research on behaviours of different materials at different temperatures - using online textbooks. A list of the initial reading will be issued early in the Term.

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group D2

	Weighting	Study time	Eligible for self-certification
Coursework - Group report	40%	24 hours	No

Group report on the experimental results of the Impact Toughness lab, during which different materials at different temperatures are tested. The report will include discussion on the effect of temperature on material properties.

Typical Group size will be 6 students, possibly 5. Will be subjected to Peer-Marking in line with the WMG policy.

Students who do not attend the lab session in the prescribed teaching block will be given an opportunity to execute the lab at a later date and produce the report in a newly-formed group .

Written exam - open book	60%	36 hours	No

On-campus examination, with access to notes and the formula booklet.

Assessment group R1

	Weighting	Study time	Eligible for self-certification
Coursework - Individual report	40%	24 hours	No
Written exam - open book	60%	36 hours	No

Feedback on assessment

Formative Feedback:

- Automated Individual feedback on on-line Moodle Revision Quiz, early in the Term.
- Cohort-level feedback on the Mock Exam submissions.
- Verbal formative feedback during seminars and practical sessions.

Summative Feedback:

- Written group-level feedback on Assessment 1 (Group Report)
- Written cohort-level feedback on Assessment 2 (Exam)

Past exam papers for WM171

Availability

Pre-requisites

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Courses

This module is Core for:

- Year 2 of DWMS-H7C7 Undergraduate Applied Professional Engineering (Control/Technical Support Engineer) (Degree Apprenticeship)
- Year 2 of DWMS-H7C6 Undergraduate Applied Professional Engineering (Electrical/Electronic Support Engineer) (Degree Apprenticeship)
- Year 2 of DWMS-H7C5 Undergraduate Applied Professional Engineering (Manufacturing Engineer) (Degree Apprenticeship)
- Year 2 of DWMS-H7C8 Undergraduate Applied Professional Engineering (Product Design and Development Engineer) (Degree Apprenticeship)