ES2J7-15 Fundamentals of Manufacturing

26/27

Department
School of Engineering
Level
Undergraduate Level 2
Module leader
Richard Watson
Credit value
15
Module duration
12 weeks
Assessment
50% coursework, 50% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

Fundamentals of Manufacturing.
This module provides a broad overview of the most widespread manufacturing processes that most engineering students are expected to know, covering the necessary process theory and complemented with practical elements going from process demonstrations to simulations.

Module aims

The module aims to provide a solid and robust understanding of common industrial manufacturing processes that by and large shape the world around us. This includes primary manufacturing processes (casting, extrusion, forging), and secondary processes (moulding, machining, cutting, forming) whilst also providing an in-depth review of non-conventional manufacturing routes.
This module will equip students with the technical fundamentals of each process and will be complemented by practical sessions where the real-life implications of the various processes are analysed, simulated and discussed, including technology demos, component-level analysis and computer process simulations.

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.

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- Introduction to Assembly Modes: Tolerances, Limits & Fits. Topics covered: Design limits and their specifications; tolerances, tolerance representations, International Tolerance Classes (IT Ranges); interacting components & fit; types of fit (clearance, interference and transitional).
- Introduction to Primary Manufacturing Processes. Casting processes (lost wax / lost foam, moulding, investment casting, die casting, and others); Metal forming processes (forging, wire drawing, rolling, extrusion, swaging, hot & cold working); Powder metallurgy, sintering.
- Fundamentals of Machining . Machining and its processes (turning, milling, drilling, grinding, and others); machining concepts & definitions; geometry of the cutting tool and ancillary cutting parameters; tool wear.
- Non-conventional machining processes. (EDM cutting, abrasive water-jet cutting, etching, electrochemical cutting, etc.).
- Sheet metal working: cutting, forming and Joining. Design for sheet metal, profiles, and cutting technologies.
- Introduction to polymer processing. Injection moulding essentials: part design, mould elements and considerations. Process simulations. Other processes: thermoforming, compression moulding and blow moulding.

Learning outcomes

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

- Develop knowledge and understanding of key manufacturing processes, including their operation fundamentals, machinery and equipment, capacity, as well as their implications in terms of shape, tolerances and accuracy. [C1, M1, C2, M2]
- To understand the material selection implications for different manufacturing routes, considering aspects of surface finish, accuracy, productivity, structural stability and sustainability. [C13, M13]
- Use of computational tools to aid in decision-making for process analysis and identify which process parameters influence variation in final product characteristics. [C3, M3]
- Develop expertise in manufacturing principles supported by up-to-date literature, trends and findings regarding design innovation. [C4,M4, C12, M12]
- To promote an appreciation for the additional implications of manufacturing technology, including health and safety, operational requirements, materials datasheets, process standardisation and regulations.

Indicative reading list

Reading lists can be found in Talis

Interdisciplinary

Although aimed at Mechanical Engineering stream students, it can include any other related engineering discipline.

International

The module is a viable route for exchange students wanting to choose a technical/practical course whilst at Warwick.

Subject specific skills

*Ability to conceive, make and realise a component, product, system or process
*The use of technical literature, datasheets, and other information sources including industry standards in the design and selection of manufacturing routes.
*Development of Design for X skills which are process-specific.

- Apply knowledge of CAD/CAM tools and technologies to propose strategies to enhance engineering design and manufacture of familiar products.
- Apply design and manufacturing methods to solve engineering problems.

Transferable skills

- Apply problem-solving skills, information retrieval, and the effective use of general IT facilities
- Plan self-learning and improve performance, as the foundation for lifelong learning.
- Exercise initiative and personal responsibility, including time management, which may be as a team member or leader.
- Appreciation of the broad implications of manufacturing routes, including their impact on sustainability.
- Professional outlook, team working capacity and leadership skills in a technical environment.
- Effective communication and the exercise of responsibility for technical decisions.
- Commit to personal learning and professional development.

Study

Study time

Type	Required
Lectures	8 sessions of 1 hour (5%)
Seminars	8 sessions of 2 hours (11%)
Total	150 hours

Type	Required
Practical classes	2 sessions of 2 hours (3%)
Online learning (independent)	8 sessions of 1 hour 30 minutes (8%)
Private study	110 hours (73%)
Total	150 hours

Private study description

All 'Independent learning' relates to Moodle pre-recorded guides, videos and activities which are meant to be followed as a sequence as part of the course.

Costs

Category	Description	Funded by	Cost to student
Other	-Safety boots and safety glasses (in case not provided in Year 1) -Consumables for EBS sessions; sample parts for analysis (casting, EDM, etc.)	Department	£0.00

Assessment

You must pass all assessment components to pass the module.

Assessment group C2

	Weighting	Study time	Eligible for self-certification
Assessment component			
Group Design and Manufacturing Project	50%		No
12 pages group report (80%) and 10 minutes group presentation including Q&A (20%)			
Reassessment component			
Individual Design and Manufacturing Project			No
10 pages report			

	Weighting	Study time	Eligible for self-certification
Assessment component			
Centrally-timetabled examination (On-campus)	50%		No

90 minutes exam which covers the theory fundamentals seen in class and the elements covered on the weekly practicals and quizzes.

- Students may use a calculator
- Answerbook Pink (12 page)
- Engineering Data Book 8th Edition

Reassessment component is the same

Feedback on assessment

*Written feedback and annotations on group report submissions via Tabula.
*In-person advice and feedback during set weekly hours.

- Cohort-level feedback on the exam.

Past exam papers for ES2J7

Availability

Courses

This module is Optional for:

- Year 2 of UESA-H315 BEng Mechanical Engineering
- Year 2 of UESA-H316 MEng Mechanical Engineering

This module is Option list A for:

- Year 2 of UESA-H216 BEng Civil Engineering
- Year 2 of UESA-H112 BSc Engineering
- Year 2 of UESA-H217 MEng Civil Engineering
- Year 2 of UESA-H316 MEng Mechanical Engineering