

Module specification

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Module Code	ENG7B2
Module Title	Digital Manufacturing and Society 5
Level	Level 7
Credit value	20
Faculty	FACE
HECoS Code	100202
Cost Code	GAME
Pre-requisite module	N/A

Programmes in which module to be offered

Programme title	Core/Optional/Standalone
MSc Engineering (Advanced Manufacturing)	Core

Breakdown of module hours

Learning and teaching hours	18 hrs
Placement tutor support hours	0 hrs
Supervised learning hours e.g. practical classes, workshops	18 hrs
Project supervision hours	0 hrs
Active learning and teaching hours total	36 hrs
Placement hours	0 hrs
Guided independent study hours	164 hrs
Module duration (Total hours)	200 hrs

Module aims

This module fuses advanced theoretical study with applied experimentation, enabling learners to interrogate, test, and extend current professional and research practice. Through a combination of conceptual exploration and laboratory enquiry, students cultivate critical evaluation, leadership, and evidence-based decision-making skills suitable for professional or doctoral progression.

This module aims to equip you with the knowledge and practical skills to design, evaluate and improve products and manufacturing systems for a Society 5.0 future, where AI, IoT and robotics enable human-centred, sustainable and inclusive industry, by integrating DFMA,



collaborative automation, digital manufacturing workflows, lifecycle thinking (including disassembly and recycling), and responsible reverse-engineering within ethical and intellectual-property frameworks.

Module Learning Outcomes

At the end of this module, students will be able to:

1	Critically evaluate the principles of Society 5.0 and Industry 5.0, assessing their implications for engineering design, manufacturing systems, and their environmental and societal impact across the full product lifecycle (AHEP-4 M7).
2	Evaluate and justify the Design for Manufacture and Assembly (DFMA) and digital manufacturing methodologies of products to create sustainable, assembly-efficient and disassembly-ready product concepts (AHEP-4 M7).
3	Design and defend a complex data-driven manufacturing solution incorporating collaborative automation, additive processes and reverse-engineering insights, while addressing intellectual property and ethical considerations (AHEP-4 M7).

Assessment

Indicative Assessment Tasks:

This section outlines the type of assessment task the student will be expected to complete as part of the module. More details will be made available in the relevant academic year module handbook.

Assessment 1:

The portfolio could include an in-class test, assessing students' understanding of Society 5.0 and Industry 5.0 principles, Design for Manufacture and Assembly (DFMA), and lifecycle considerations.

The portfolio could then include an applied task, where students will develop and communicate a digitally enabled manufacturing solution, drawing on DFMA, collaborative automation, additive manufacturing, and reverse engineering as appropriate. Consideration should also be given to intellectual property, ethical implications, and the evaluation of environmental and societal impacts.

Assessment number	Learning Outcomes to be met	Type of assessment	Duration/Word Count	Weighting (%)	Alternative assessment, if applicable
1	1-3	Portfolio	4000	100	N/A

Derogations

Credits shall be awarded by an Assessment Board for those modules in which a mark of at least 50% has been achieved, with a minimum mark of 40% in each element of assessment

Learning and Teaching Strategies

Learning integrates advanced theoretical study with applied experimentation, enabling students to test and extend current professional and research practice. Face-to-face sessions are complemented by virtual discussions, simulations, and case studies to support analytical depth. Tutorials and supervision focus on independent enquiry, innovation, and leadership in addressing complex challenges.

Welsh Elements

This module will be delivered through the medium of English; however, students have the option to submit their assessments in the medium of Welsh. While this module is not currently offered fully through Welsh, Welsh language support and guidance are available, and some learning materials or tutorial discussions may incorporate Welsh elements where appropriate. To further promote bilingual learning, all students have the opportunity to take the 20-credit Welsh for STEM short course, designed to develop confidence and subject-specific language skills in both English and Welsh.

Indicative Syllabus Outline

- Industry 4.0, Industry 5.0 & Society 5.0: Cyber-physical systems, digital twins and human-centric manufacturing; evaluating societal and environmental impacts of technology adoption.
- Future Trends: AI-assisted design, autonomous factories and circular business models; anticipating policy and skills for a socially responsible future.
- Design for Manufacture, Assembly & Production (DFMA/DFX): Principles for reducing part count, improving assembly efficiency and enabling disassembly/recycling; trade-offs between cost, quality and sustainability.
- Additive Manufacturing & 3D Scanning: Process families, scan-to-CAD workflows and metrology; assessing lifecycle benefits and resilience.
- Collaborative Automation & Smart Systems: Cobots, IoT integration, data analytics and safety; designing inclusive, efficient workcells.
- Reverse Engineering, IP & Patents: Benchmarking techniques, scan/measure/compare pipelines, and ethical/legal compliance for redesign.

Indicative Bibliography

Please note the essential reads and other indicative reading are subject to annual review and update.

Essential Reads:

M. Ghobakhloo, H. A. Mahdiraji, M. Iranmanesh, et al., "From Industry 4.0 digital manufacturing to Industry 5.0 digital society: A roadmap toward human-centric, sustainable, and resilient production," *Information Systems Frontiers*, 2024. [Online]. Available: <https://doi.org/10.1007/s10796-024-10476->

Administrative Information

For office use only	
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