

Module specification

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Module Code	ENG6C6
Module Title	Mechanical Modelling & Simulation
Level	6
Credit value	20
Faculty	FACE
HECoS Code	100190
Cost Code	GAME
Pre-requisite module	N/A

Programmes in which module to be offered

Programme title	Core/Optional/Standalone
BEng (Hons) Industrial Engineering (Mechanical)	Core
BEng (Hons) Industrial Engineering (Mechatronics)	
BEng (Hons) Mechanical Engineering with Manufacture	
BEng (Hons) Aerospace Engineering	
BEng (Hons) Mechanical Engineering	
BEng (Hons) Motorsport Engineering	

Breakdown of module hours

Learning and teaching hours	0 hrs
Placement tutor support hours	0 hrs
Supervised learning hours e.g. practical classes, workshops	36 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 immerses students in a fully applied environment where knowledge is demonstrated through independent investigation and experimentation. Learners plan,

implement, and analyse practical work to address defined challenges, showing mastery of specialist techniques. The approach promotes innovation, professional integrity, and confidence in leading complex projects.

This module aims to develop students' advanced understanding of mechanical modelling and simulation and their application to complex engineering systems. It equips students with the advanced knowledge and practical skills required to apply sophisticated modelling techniques to analyse, evaluate, and solve complex engineering problems, enabling the independent assessment and optimisation of mechanical and fluid systems for industrial applications.

Module Learning Outcomes

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

1	Construct and validate models of mechanical systems using mathematical techniques, demonstrating accuracy and relevance to real-world applications (AHEP-4 C1, C3).
2	Evaluate and justify the selection of computational and analytical techniques for modelling and simulation, recognising limitations and proposing improvements (AHEP-4 C3).
3	Critically interpret and integrate simulation outputs to develop evidence-based recommendations for optimising the performance of mechanical systems, demonstrating professional judgement and consideration of practical constraints.

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: Coursework

Students will produce a technical report that demonstrates their knowledge and understanding of advanced mechanical modelling and simulation through the analysis of a complex engineering problem defined by specified parameters and design criteria. The assessment provides an opportunity for students to justify design decisions using appropriate evidence, including results derived from laboratory investigations and relevant academic or industrial literature.

Assessment number	Learning Outcomes to be met	Type of assessment	Duration/Word Count	Weighting (%)	Alternative assessment, if applicable
1	1-3	Coursework	3000	100	N/A

Derogations

Credits shall be awarded by an Assessment Board for those modules in which a pass mark 40% has been achieved, with a minimum mark of 30% in each assessment element.

Learning and Teaching Strategies

Learning is fully immersive and practice-driven, requiring students to apply advanced knowledge through sustained experimental and investigative work. Independent planning, execution, and analysis of complex tasks are central to study. Digital learning tools support data handling and reflection, while supervision ensures critical engagement and alignment with professional and research standards.

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

Advanced FEA Theory and Formulation: Development of in-depth knowledge of finite element analysis (FEA) theory, including governing equations, numerical formulation, and underlying modelling assumptions for complex engineering systems.

Modelling of Complex Mechanical Systems: Application of advanced modelling approaches to represent complex mechanical systems, ensuring appropriate abstraction, boundary conditions, and representation of real-world behaviour.

Practical Implementation of Advanced FEA Techniques: Application of advanced FEA tools and computational methods to analyse complex engineering problems, including model setup, meshing strategies, and solution techniques.

Method Selection and Justification: Selection and justification of appropriate modelling methods, tools, and assumptions to ensure valid and reliable analysis outcomes for engineering applications.

Interpretation and Critical Assessment of FEA Results: Evaluation and critical interpretation of simulation results, including identification of errors, limitations, and the validity of model assumptions in supporting engineering decisions.

Design Optimisation and Industrial Application: Application of optimisation techniques to improve mechanical system performance, integrating simulation results into design decision-making for industrial engineering applications.

Indicative Bibliography

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

Essential Reads:

Z. Bi, *Finite Element Analysis Applications: A Systematic and Practical Approach*. Oxford, UK: Elsevier, 2018.

Other indicative reading:

S. A. Ragab and H. E. Fayed, *Introduction to Finite Element Analysis for Engineers*, 2nd ed. Boca Raton, FL, USA: CRC Press, 2024.

Administrative Information

For office use only	
Initial approval date	June 2026
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Date and details of revision	
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