Prifysgol Wrecsam
Wrexham University

Module specification

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Module Code	ENG5C1
Module Title	Mechanical Design and Analysis
Level	5
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
FdEng Industrial Engineering (Mechanical) BEng (Hons) Mechanical Engineering with Manufacture BEng (Hons) Aerospace Engineering BEng (Hons) Mechanical Engineering BEng (Hons) Motorsport Engineering	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 develops applied understanding through a balance of theory and practice. Learners undertake both classroom study and supervised practical activity to explore design, implementation, and evaluation processes. Collaborative work and enquiry-based learning foster communication, teamwork, and the confidence to apply problem-solving techniques in

varied contexts. This module aims to develop students' understanding of material degradation mechanisms over time and the influence of design decisions on overall structural strength and integrity.

Module Learning Outcomes

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

1	Determine equivalent models for rigid body systems, analyse and evaluate their dynamic behaviour by using notions of experimental dynamics
2	Assess modes of failure for components under various loading conditions (principal stresses, Mohr's circle).
3	Solve the deflection of complex structures under the combination of various loading conditions making use of the superposition method and the direct integration method and computational analysis.

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: Portfolio

The assessment is undertaken through a structured portfolio designed to address and demonstrate achievement of all module learning outcomes.

The portfolio comprises a balanced combination of practical and theoretical calculations, requiring students to apply fundamental principles of engineering mechanics, materials, and structural analysis to a range of problem-based tasks. Students are expected to demonstrate analytical competence, correct use of mathematical and engineering methods, appropriate assumptions, and clear presentation of working and results.

The portfolio approach allows for the progressive development of understanding across the module, encouraging the integration of theory with applied problem solving.

Assessment number	Learning Outcomes to be met	Type of assessment	Duration/Word Count	Weighting (%)	Alternative assessment, if applicable
1	1-3	Portfolio	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 integrates conceptual study with practical investigation to deepen understanding and enhance problem-solving ability. Students participate in lectures, laboratory work, and team-based projects that encourage collaboration and communication. Online materials, recordings, and discussion forums support blended engagement. Tutorials promote reflective learning and increasing autonomy in preparation for advanced study.

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

- **Engineering Structures and Dynamics**: Introduction to fundamental concepts of engineering structures and dynamics, providing the theoretical basis for rigid body modelling and system behaviour.
- **Equivalent Modelling of Rigid Body Systems**: Development of simplified, idealised models to represent real rigid body systems accurately, supporting analytical evaluation and system interpretation.
- **Dynamic Behaviour of Rigid Body Systems**: Analysis and evaluation of rigid body system responses under dynamic loading conditions, incorporating principles and techniques associated with experimental dynamics.
- **Stress, Strain, and Failure Concepts**: Introduction to material behaviour under load, including stress–strain relationships and fundamental failure mechanisms.
- **Bending of Beams and Modes of Failure**: Examination of beam behaviour under bending loads, with analysis of associated stresses, deflections, and failure modes.
- **Buckling of Slender Beams (Euler Theory)**: Application of Euler's buckling theory to determine critical loads for slender columns with varying end fixation conditions.
- **Beam Deflection Theory**: Introduction to elastic beam theory and governing equations for deflection analysis under different loading scenarios.
- **Superposition Method for Beam Deflection**: Application of the superposition principle to determine beam deflections resulting from multiple simultaneous loads.

- **Direct Integration Method for Beam Deflection**: Use of direct integration techniques to solve beam deflection problems analytically, ensuring correct application of boundary and continuity conditions.

Indicative Bibliography

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

Essential Reads:

R.C. Hibbeler, Mechanics of Materials, 11th ed. Singapore: Pearson, 2023.

Other indicative reading:

A. Pytel, et. al., Mechanics of materials. Stamford, CT: Cengage Learning, 2012.

Administrative Information

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