Prifysgol Wrecsam
Wrexham University

Module specification

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Module Code	ENG6D5
Module Title	Mechanical Systems Integration
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) Mechanical Engineering	Core

Breakdown of module hours

Learning and teaching hours	21 hrs
Placement tutor support hours	0 hrs
Supervised learning hours e.g. practical classes, workshops	21 hrs
Project supervision hours	0 hrs
Active learning and teaching hours total	**42 hrs**
Placement hours	0 hrs
Guided independent study hours	158 hrs
Module duration (Total hours)	**200 hrs**

Module aims

This module integrates advanced theoretical study with applied laboratory investigation. Students critically evaluate techniques, interpret data, and justify design or methodological decisions within a professional context. The combination of theory and practice cultivates independent learning, innovation, and readiness for individual project or dissertation work.

This module aims to develop students' ability to model, analyse, and integrate the kinematic and dynamic behaviour of particles, rigid bodies, and mechanical systems. It equips students to make informed engineering judgements in the analysis and evaluation of complex mechanical motion.

Module Learning Outcomes

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

1	Analyse and model the kinematics of particles, rigid bodies, and planar mechanisms in 2D and 3D by applying appropriate reference frames, coordinate systems, and motion composition methods (AHEP-4 C1).
2	Apply Newtonian, energy, and momentum methods to determine the dynamic response of particles, rigid bodies, and interconnected systems undergoing translational and rotational motion.
3	Integrate kinematic and dynamic analyses to evaluate mechanical system behaviour, justify modelling assumptions, and critically interpret analytical and numerical results.

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

Assessment is undertaken through a portfolio designed to cover all learning outcomes, comprising an individual analytical problem (in class test) and a mechanical system modelling project. The portfolio enables students to demonstrate both theoretical understanding and practical application of modelling and analysis techniques.

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 combines theoretical exploration with applied laboratory investigation to bridge conceptual understanding and professional competence. Students critically analyse data, test approaches, and evaluate outcomes in practical settings. Blended delivery through the Virtual Learning Environment supports flexibility and reflection. Tutorials focus on independent enquiry, innovation, and readiness for project or dissertation work.

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

Particle Kinematics and Coordinate Systems: Analysis of particle motion in two and three dimensions, including vector representation of position, velocity, and acceleration in multiple coordinate systems and reference frames.

Kinematic Modelling of Mechanical Systems: Application of degrees of freedom analysis, kinematic classification of planar mechanisms, and transformation methods to model motion within complex mechanical systems.

Rigid Body Dynamics in Three Dimensions: Application of Newtonian principles to rigid bodies, including translational and rotational motion, angular velocity and acceleration, and formulation of equations of motion in moving reference frames.

Dynamic Analysis Techniques: Use of energy and momentum methods to evaluate system behaviour, including interactions between components within interconnected mechanical systems.

Systems Integration and Modelling Assumptions: Integration of kinematic and dynamic models to analyse overall system behaviour, including critical evaluation of modelling assumptions and their validity.

Interpretation of Mechanical System Behaviour: Analysis and interpretation of analytical results to assess system performance under realistic operating conditions, supporting informed engineering judgement.

Indicative Bibliography

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

Essential Reads:

F. P. Beer and E. R. Johnston, Jr., *Vector Mechanics for Engineers: Dynamics*, 13th ed. New York, NY, USA: McGraw-Hill Education, 2025.

Other indicative reading:

J. L. Meriam and L. G. Kraige, Engineering Mechanics: Dynamics, 8th ed. Hoboken, NJ, USA: Wiley, 2015.

R. C. Hibbeler, Engineering Mechanics: Dynamics, 15th ed. Harlow, UK: Pearson, 2023.

Plus, various others to be signposted on Moodle.

Administrative Information

For office use only	
Initial approval date	June 2026
With effect from date	September 2026
Date and details of revision	
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