

## Module specification

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<b>Module Code</b>	ENG6AM
<b>Module Title</b>	Further Control Systems Engineering
<b>Level</b>	6
<b>Credit value</b>	20
<b>Faculty</b>	FACE
<b>HECoS Code</b>	100209
<b>Cost Code</b>	GAME
<b>Pre-requisite module</b>	None

### Programmes in which module to be offered

<b>Programme title</b>	<b>Core/Optional/Standalone</b>
BEng (Hons) Mechatronics Engineering	Optional

### Breakdown of module hours

Learning and teaching hours	60 hrs
Placement tutor support hours	0 hrs
Supervised learning hours e.g. practical classes, workshops	0 hrs
Project supervision hours	0 hrs
<b>Active learning and teaching hours total</b>	<b>60 hrs</b>
Placement hours	0 hrs
Guided independent study hours	140 hrs
<b>Module duration (Total hours)</b>	<b>200 hrs</b>

### Module aims

1. To extend mathematical modelling to predict and modify control system behaviour.
2. To analyse modern control theories, approaches and applications.
3. To extend established analytical skills by applying computer-based tools to control system design, simulation, implementation and modification.
4. To critically evaluate control systems.

## Module Learning Outcomes

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

<b>1</b>	Determine and apply appropriate methods for modelling and analysing problems in industrial control systems.
<b>2</b>	Critically analyse and predict the performance of a computer-controlled system
<b>3</b>	Design and/or modify, using computer aided techniques, a control system to a specified performance using the state space approach.
<b>4</b>	Develop critical knowledge and skills in control system design and evaluation, engineering professional codes of conduct and ethical conduct in control engineering, control system reliability, operation risks, environmental and commercial risks, health and safety.

## 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 of activity evidence – Candidates will work on problems on control systems design and analysis, computer-based tools for control system design, simulation and analysis. A written report will be submitted for the assessment.

Assessment number	Learning Outcomes to be met	Type of assessment	Duration/Word Count	Weighting (%)	Alternative assessment, if applicable
1	1,2,3,4	Portfolio	4000	100%	

## Derogations

None

## Learning and Teaching Strategies

The module will be delivered through lectures and student-driven investigative work. A significant amount of the content is to be achieved through individual study. Approximately one third of the timetabled time will be devoted to formal lectures. The remainder of the time will be allocated to tutorials and to individual study but also with some programmed access to lab/computer facilities, for practical investigation and analysis activities.

## Welsh Elements

Programme is delivered in English and Chinese, however students can submit assessments in Welsh.



## Indicative Syllabus Outline

Modelling and simulation of dynamic processes: Different types of mathematical models for an industrial dynamic process; Mechanistical analysis-based modelling; Empirical databased modelling; Linear time invariant models; Model structure selection; Model parameter identification/estimation.

Discrete time control systems: Sampling and aliasing; Difference equations and Z transforms; The Z plane; System classification and frequency response; Digital filters; Digital implementation of analogue controllers.

Multivariable control systems: State space equations; State equations from transfer functions; Controllability and observability; Solution of state equation; Application of state feedback; State estimator; poles and zeros.

Adaptive control of industrial dynamic processes: Lyapunov stability; Lyapunov direct method; Lyapunov indirect method; Model reference adaptive control; Self tuning control.

AI Control: Fuzzy logic, Fuzzy membership function, Fuzzy operators, Fuzzification and defuzzification; Fuzzy rules and fuzzy control; Neural networks; Multi-layer networks and BP training; Neural-network-based control.

Case studies: Industrial process control systems design, implementation, operation, maintenance; social, economic, commercial and ethical issues in control engineering; health and safety, system reliability and operation risk assessment, commercial and environmental risks.

## Indicative Bibliography

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

Essential Reads:

R. C. Dorf and R. H. Bishop, Modern Control Systems. 14th ed. Pearson Prentice Hall, 2021.

Other indicative reading:

N. S. Nise, Control Systems Engineering. New Jersey: John Wiley and Sons, 2020.

M. Negnevitsky, Artificial Intelligence: A Guide to Intelligent Systems. 3rd ed. Pearson Education, 2011.

## Administrative Information

For office use only	
Initial approval date	24/09/2020
With effect from date	24/09/2020
Date and details of revision	22/07/2025 revalidated, LO's 1 and 4 reworded not changed, assessment 2 recategorized to portfolio, updated template, derogation removed 02/04/2026 CMAP approval to change the assessments from an exam and portfolio to one portfolio from Sept 26 (AM2)
Version number	3

