Prifysgol Wrecsam
Wrexham University

Module specification

When printed this becomes an uncontrolled document. Please access the Module Directory for the most up to date version by clicking on the following link: Module directory

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

Programmes in which module to be offered

Programme title	Core/Optional/Standalone
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
Active learning and teaching hours total	**0** hrs
Placement hours	0 hrs
Guided independent study hours	140 hrs
Module duration (Total hours)	200 hrs

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:

1	Determine and apply appropriate methods for modelling and analysing problems in industrial control systems.
2	Critically analyse and predict the performance of a computer-controlled system.
3	Design and/or modify, using computer aided techniques, a control system to a specified performance using the state space approach.
4	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: Exam – At the end of semester, candidates will sit in an unseen written exam

Assessment 2: Portfolio of activity evidence – Candidates will work on problems to apply 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	2, 3	Examination	2 hrs	50%	
2	1, 4	Portfolio	2500 words	50%	

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 de-fuzzification; 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

For office use only	
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
Version number	2