Module specification

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Refer to the module guidance notes for completion of each section of the specification.

Module code	ENG6AM
Module title	Further Control Systems Engineering
Level	6
Credit value	20
Faculty	FAST
Module Leader	Dr Jinshi Lu
HECoS Code	100209
Cost Code	GAME

Programmes in which module to be offered

Programme title	Is the module core or option for this programme
BEng (Hons) Mechatronics Engineering	Core

Pre-requisites

None

Breakdown of module hours

Learning and teaching hours	60 hrs
Placement tutor support	0 hrs
Supervised learning e.g. practical classes, workshops	0 hrs
Project supervision (level 6 projects and dissertation modules only)	0 hrs
Total active learning and teaching hours	**0** hrs
Placement / work based learning	0 hrs
Guided independent study	140 hrs
Module duration (total hours)	200 hrs

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Initial approval date	24/09/2020
With effect from date	24/09/2020
Date and details of revision	
Version number	1

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	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	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

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.

Indicative Assessment Tasks:

The assessment of this module consists of two parts:

1. 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.
2. Exam – At the end of semester, candidates will sit in an unseen written exam.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)
1	2, 3	Examination	50%
2	1, 4	Case Study	50%

Derogations

A derogation from regulations has been approved for this programme which means that whilst the pass mark is 40% overall, each element of assessment (where there is more than one assessment) requires a minimum mark of 30%.

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.

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

Kalpakhian, S. and Schmid, S. (2016), Manufacturing Processes for Engineering Materials. 6th ed. Harlow: Pearson Education.

Other indicative reading

Dickersbach, J.T. and Keller, G. (2010) Production Planning and Control with SAP ERP, 2nd Edn., SAP Press/Galileo Press.

Miltenburg, J. (2005) Manufacturing Strategy: How to Formulate and Implement a Winning Plan, 2nd Edn., Productivity Press.

Slack, N. and Brandon-Jones, A. (2019), Operations Management. 9th ed. Harlow: Pearson Education.

Employability skills – the Glyndŵr Graduate

Each module and programme is designed to cover core Glyndŵr Graduate Attributes with the aim that each Graduate will leave Glyndŵr having achieved key employability skills as part of their study. The following attributes will be covered within this module either through the content or as part of the assessment. The programme is designed to cover all attributes and each module may cover different areas. Click here to read more about the Glyndwr Graduate attributes

Key Attitudes
Adaptability

Practical Skillsets
Digital Fluency
Leadership and Team working
Communication