Module specification

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Module Code	ENG782
Module Title	Intelligent System Design & Control Engineering
Level	7
Credit value	20
Faculty	FAST
HECoS Code	100166
Cost Code	GAME

Programmes in which module to be offered

Programme title	Is the module core or option for this programme
MSc Engineering (Aeronautical) MSc Engineering (Aeronautical) with Advanced Practice MSc Engineering (Mechanical Manufacture) MSc Engineering (Mechanical Manufacture) with Advanced Practice MSc Engineering (Automotive) MSc Engineering (Automotive) with Advanced Practice MSc Engineering (Renewable & Sustainable Energy) MSc Engineering (Renewable & Sustainable Energy) with Advanced Practice MSc Engineering (Electrical & Electronic) MSc Engineering (Electrical & Electronic) with Advanced Practice MSc Engineering (Management) MSc Engineering (Management) with Advanced Practice MEng Aeronautical Engineering MEng Automotive Engineering MEng Electrical and Electronic Engineering MEng Mechanical Engineering MEng Renewable and Sustainable Engineering	Optional

Pre-requisites

None

Breakdown of module hours

Learning and teaching hours	30 hrs
Placement tutor support	0 hrs
Supervised learning e.g., practical classes, workshops	0 hrs

Learning and teaching hours	30 hrs
Project supervision (level 6 projects and dissertation modules only)	0 hrs
Total active learning and teaching hours	**30** hrs
Placement / work-based learning	0 hrs
Guided independent study	170 hrs
Module duration (total hours)	200 hrs

For office use only	
Initial approval date	22nd Aug 2022
With effect from date	Sept 2022
Date and details of revision	
Version number	1

Module aims

The aims of this module are stated as follows:

- Familiarisation with modern intelligent systems – architecture, working principle, design parameters and constraints.

- Working knowledge of general and application-specific usage of artificial intelligence techniques for the design and development of engineering systems.

- Develop mastery of dynamic system analysis, the theory of modelling, simulation and control of dynamic systems in the context of practical engineering applications and advanced control theories.

Module Learning Outcomes - at the end of this module, students will be able to:

In addition to the module learning outcomes, students will also cover the following accreditation of higher education programme (AHEP) fourth edition learning outcomes: **M2 & M4**

1	Describe the software and hardware architectures of intelligent systems in various domains
2	Demonstrate broad and domain-specific practical knowledge of engaging artificial intelligence techniques for real-world system-level design and development.
3	Select and apply appropriate methods for modelling and analysing engineering dynamic systems; simulate control systems and analyse the outputs of complex applications.

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: An individually prepared portfolio consisting of a range of assessments such as case studies, laboratory work and Moodle Quiz, introducing the topic areas of each learning outcomes. Guidance material will be provided, which the students will use to generate a Portfolio of work. Assessment one is an individual prepared portfolio and represents 100% of the overall module mark.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)
1	1-3	Portfolio	100%

Derogations

Credits shall be awarded by an assessment board for those Level 7 modules in which an overall mark of at least 50% has been achieved with a minimum mark of 40% in each assessment element.

Learning and Teaching Strategies

A series of workshop style lectures with student-led seminars and small group activities. Directed learning using library and internet resources will be facilitated using Moodle and MS Teams. This module will also follow the ALF (Active Learning Framework) guidelines, which will include alternative methods of assessment and a blended approach to delivery, with some theory and software sessions being delivered online (depending on requirements and student experience).

Indicative Syllabus Outline

Introduction to Intelligent Systems (Natural Intelligence v Artificial Intelligence and Knowledge-based Intelligent Systems); Expert Systems (Rule-based and Fuzzy); Evolutionary Computation (Genetic Algorithms, Particle Swarm Optimization and Differential Evolution); Machine Learning (Supervised Learning, Unsupervised Learning and Reinforcement learning).

Classical control system analysis and design (Laplace transforms and transfer function; Dynamic system response; System stability, stability criteria); State space representation of a dynamic system (State feedback control design; Full-order and reduced-order state estimators); Digital control systems: (Sampling theory; Z-transform; Stability criteria)

Indicative Bibliography:

Essential Reads

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

Other indicative reading

T. Rappaport, *Wireless Communications: Principles and Practice.* 2nd ed. *Pearson* Prentice Hall, 2017.

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

A. Goldsmith, *Wireless Communications*. Cambridge University Press, 2005.

Plus, various others to be signposted on Moodle

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.

Core Attributes
Engaged
Enterprising
Creative
Ethical

Key Attitudes
Commitment
Curiosity
Resilience
Confidence
Adaptability

Practical Skillsets
Digital Fluency
Organisation
Critical Thinking
Emotional Intelligence
Communication