Module Descriptor

Title	Process Dynamics and Control		
Session	2025/26	**Status**	Published
Code	ENGG10044	**SCQF Level**	10
Credit Points	20	**ECTS (European Credit Transfer Scheme)**	10
School	**Computing, Engineering and Physical Sciences**		
Module Co-ordinator	L Rolland		

Summary of Module

This module is intended to provide students with dynamics and controls of chemical engineering processes as they are relevant in the contemporary engineering profession.

This module brings together the knowledge gained in previous years in the fields of process modelling, process safety, process monitoring and process control (regarding L1).

It develops students' ability to carry out the calculations necessary to design control systems using both the Laplace domain, transfer functions, time domain analysis and the frequency analysis techniques (regarding L3).

It reviews the process modelling principles then discusses linearization of non-linear models, system response (1st, 2nd and more complicated systems), the effect of time delay and the phenomena of inverse response (regarding L3).

The module provides a detailed discussion of the different control strategies and control modes employed in the process industry such as feedback control, feed-forward control, ratio control, cascade control, as well as stability and controller design and tuning relations (regarding L4). Advanced control techniques, multi-loop and multivariable control, and process monitoring using machine learning will be covered, as will an appreciation of cyber security for the protection of commercial and control data (regarding L5).

The module discusses plant-wide control and the use of information gained from HAZOP and other hazard assessment and identification techniques in the design of control systems and individual equipment operational control loops (regarding L2). Systems for start-up and shut-down form an integral part of the course. Control valves with their actuators, alarms, relief valves and relief systems are also covered in the module.

• I am UWS (https://www.uws.ac.uk/current-students/your-graduate-attributes/): Upon completing this module the students will be equipped with tools that will help them in their journey to be work-ready, successful and universal. The module develops critical thinking and analytical skills that enhance the students' ability to deal with complicated issues and make them problem solvers. It encourages them to become motivated, innovative, autonomous, inquisitive, creative and imaginative. The module and the teaching approach encourage collaborative working, effective communications, resilience and perseverance, and development of research and inquiry skills. The aim is to produce graduates who are knowledgeable with excellent digital skills fit for the 21st century and aware of the global context in which they operate and the challenges that face humanity in the 21st century in the areas of water, food, energy, environment and well-being, who strive to lead, influence and dare to make transformational changes while being ethically-minded, socially responsible,

critically aware of the environmental and social impacts of their decisions and actions, and culturally sensitive.

Module Delivery Method	**On-Campus**[1] ☒	**Hybrid**[2] ☐	**Online**[3] ☐	**Work -Based Learning**[4] ☐
Campuses for Module Delivery	☐ Ayr ☐ Dumfries	☐ Lanarkshire ☐ London ☒ Paisley	☐ Online / Distance Learning ☐ Other (specify)	

Terms for Module Delivery	Term 1	☐	Term 2	☒	Term 3	☐
Long-thin Delivery over more than one Term	Term 1 – Term 2	☐	Term 2 – Term 3	☐	Term 3 – Term 1	☐

Learning Outcomes	
L1	Demonstrate a critical understanding of chemical processes dynamics and their related control systems while grasping the impacts, benefits and risks of digitalisation including the role they play in the safe and economic operation of the process industry.
L2	Demonstrate critical understanding of the role of hazard assessment techniques in the safe operation and control of chemical plants. Adopt a holistic and proportionate approach to the mitigation of security risks using measurement, controls and automation.
L3	Derive process models and manipulate them to enable the deduction of the steady-state and transient behaviours and transient behaviours of a system quantitatively.
L4	Critically understand the different control modes and control strategies and the basis for selection, specification, implementation and field tuning of control systems.
L5	Identify and implement control strategies for specific equipment and systems.

Employability Skills and Personal Development Planning (PDP) Skills	
SCQF Headings	**During completion of this module, there will be an opportunity to achieve core skills in:**
Knowledge and Understanding (K and U)	**SCQF 10** Demonstrate a critical knowledge of control systems and their operation.

[1] Where contact hours are synchronous/ live and take place fully on campus. Campus-based learning is focused on providing an interactive learning experience supported by a range of digitally-enabled asynchronous learning opportunities including learning materials, resources, and opportunities provided via the virtual learning environment. On-campus contact hours will be clearly articulated to students.

[2] The module includes a combination of synchronous/ live on-campus and online learning events. These will be supported by a range of digitally-enabled asynchronous learning opportunities including learning materials, resources, and opportunities provided via the virtual learning environment. On-campus and online contact hours will be clearly articulated to students.

[3] Where all learning is solely delivered by web-based or internet-based technologies and the participants can engage in all learning activities through these means. All required contact hours will be clearly articulated to students.

[4] Learning activities where the main location for the learning experience is in the workplace. All required contact hours, whether online or on campus, will be clearly articulated to students

	Develop a critical and analytical approach to control systems and their role in the safe operation of chemical processes.
Practice: Applied Knowledge and Understanding	**SCQF 10** Apply process control techniques in the design of safe operations. Use a range of skills in solving problems in proces control.
Generic Cognitive skills	**SCQF 10** Critically conceptualise the details of a control system and the role process control plays in the safe operation chemical plants and their role in safety and environmental protection.
Communication, ICT and Numeracy Skills	**SCQF 10** Be able to explain and communicate all the details of a control system clearly, precisely and without any ambiguity to the team, the management and other concerned parties such as the authority and the public.
Autonomy, Accountability and Working with Others	**SCQF 10** Deal with complex issues related to process control in teams within and out with the organisation. To present information about a process control system in clear precise scientific and engineering manner.

Prerequisites	**Module Code** N/A	**Module Title** N/A
	Other	
Co-requisites	**Module Code** N/A	**Module Title** N/A

Learning and Teaching	
In line with current learning and teaching principles, a 20-credit module includes 200 learning hours, normally including a minimum of 36 contact hours and maximum of 48 contact hours. The Learning & Teaching Strategy for this module is based on the general strategy for the MSc Project Management. Classes are delivered on a weekly basis. Lectures introduce and exemplify key theoretical and critical concepts. Tutorial sessions will be given to further develop students' understanding and facilitate them to practice managing a project within their groups. Students are given sufficient time and support to work on the coursework. For Distance Learning students and hybrid/blended deliveries, full use will be made of the VLE. That is, all teaching material will be made available online and students will be guided through the material. Email and videoconferencing will be used to support students. The class test will need to take place at a designated remote site under UWS protocols.	
Learning Activities During completion of this module, the learning activities undertaken to achieve the module learning outcomes are stated below:	**Student Learning Hours** (Note: Learning hours include both contact hours and hours spent on other learning activities)
Lecture / Core Content Delivery	18
Tutorial / Synchronous Support Activity	18

Laboratory / Practical Demonstration / Workshop	12
Independent Study	152
n/a	0
n/a	0
TOTAL	200

Indicative Resources

The following materials form essential underpinning for the module content and ultimately for the learning outcomes:

Dale E. Seborg, Thomas F. Edgar, Duncan A. Mellichamp (2016) Process Dynamics and Control, 4th ed., Wiley.

King, M. (2016) Process Control: A Practical Approach. Chichester: Wiley. 2nd edition.

Luyben, Tyreus and Luyben (1998) Plantwide Process Control. McGraw Hill.

Thomas Marlin (2014) Process Control, Designing Processes and Control, System Dynamics Performance, 2nd edition, McGraw-Hill.

IChemE Knowledge Hub (various articles)

(N.B. Although reading lists should include current publications, students are advised (particularly for material marked with an asterisk*) to wait until the start of session for confirmation of the most up-to-date material)

Attendance and Engagement Requirements

In line with the Student Attendance and Engagement Procedure, Students are academically engaged if they are regularly attending and participating in timetabled on-campus and online teaching sessions, asynchronous online learning activities, course-related learning resources, and complete assessments and submit these on time.

For the purposes of this module, academic engagement equates to the following:

The School of Computing, Engineering and Physical Sciences considers attendance and engagement to mean a commitment to attending, and engaging in, timetabled sessions. You will scan your attendance via the scanners each time you are on-campus and you will login to the VLE several times per week. Where you are unable to attend a timetabled learning session due to illness or other circumstance, you should notify the Programme Leader that you cannot attend. Across the School an 80% attendance threshold is set. If you fall below this, you will be referred to the Student Success Team to see how we can best support your studies.

Equality and Diversity

The University's Equality, Diversity and Human Rights Procedure can be accessed at the following link: UWS Equality, Diversity and Human Rights Code.

Aligned with the University's commitment to equality and diversity, this module supports equality of opportunity for students from all backgrounds and learning needs. Using the VLE, material will be presented electronically in formats that allow flexible access and manipulation of content. This module complies with University regulations and guidance on inclusive learning and teaching practice. This module has lab-based teaching and as such you are advised to speak to the Module Co-ordinator to ensure that specialist assistive equipment, support provision and adjustment to assessment practice can be put in place, in accordance with the University's policies and regulations.

(N.B. Every effort will be made by the University to accommodate any equality and diversity issues brought to the attention of the School)

Supplemental Information

Divisional Programme Board	**Engineering Physical Sciences**
Overall Assessment Results	☐ **Pass / Fail** ☒ **Graded**
Module Eligible for Compensation	☐ **Yes** ☒ **No** **If this module is eligible for compensation, there may be cases where compensation is not permitted due to programme accreditation requirements. Please check the associated programme specification for details.**
School Assessment Board	Engineering
Moderator	L Sun
External Examiner	P Weston
Accreditation Details	This module is part of the BEng(Hons) Chemical Engineering programme accredited by the IChemE.
Module Appears in CPD catalogue	☐ **Yes** ☒ **No**
Changes / Version Number	1.07 - Updated Attendance and Engagement Procedure. - Updated Equality and Diversity. - Updated external examiner. - Updated Assessment section. - Unseen closed book class test added in lieu of open book examination.

Assessment (also refer to Assessment Outcomes Grids below)
Assessment 1
final written exam worth 70% of the final mark (COMPONENT 1)
Assessment 2
continuous assessment worth 30% of the final mark and it consist of a written assignment and a laboratory report (COMPONENTS 2 & 3)
Assessment 3
(N.B. (i) Assessment Outcomes Grids for the module (one for each component) can be found below which clearly demonstrate how the learning outcomes of the module will be assessed. (ii) An indicative schedule listing approximate times within the academic calendar when assessment is likely to feature will be provided within the Student Module Handbook.)

Component 1							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**

Unseen closed book class test	☐	☐	☒	☒	☐	70	3

Component 2							
Assessment Type	**LO 1**	**LO 2**	**LO 3**	**LO 4**	**LO 5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
Design/Diagram/Drawing/Sketch/Photograph	☒	☒	☐	☒	☒	15	0

Component 3							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
Laboratory/Clinical/Field notebook	☒	☐	☐	☒	☐	15	0
Combined total for all components						100%	3 hours

Change Control

What	**When**	**Who**
Module Descriptor converted to new format for AY 2025/2026.	March 2025	Andy Durrant
Switch to closed book exam Updated indicatives resources	March 2025	Andy Durrant