University of the West of Scotland

Module Descriptor

Session: 2024-25

Title of Module: Process Modelling and Simulation			
Code: ENGG08024	**SCQF Level: 8 (Scottish Credit and Qualifications Framework)**	**Credit Points: 20**	**ECTS: 10 (European Credit Transfer Scheme)**
School:	School of Computing, Engineering and Physical Sciences		
Module Co-ordinator:	Li Sun		

Summary of Module

Introduction to process modelling and simulation. Model hierarchy and its importance in analysis.
Application areas of process models: Uses of models, limitations of process models
Classification of process models: Fundamental, empirical, semi-empirical, analogous, steady state models, dynamic models, discrete models, differential models, deterministic vs stochastic models.
Development and formulation of process models: assumptions, approximations, accuracy, and simplifications.
Development of empirical models: data fitting
Solutions of the models: Analytical techniques, numerical techniques.
Development of understanding system dynamics.
Process Simulation: Structure of process simulators, modular approach vs equation-oriented approach, selection of properties packages.
Advanced CAD including 3-D representation of items.
Examples from reactor design, heat transfer, fluid flow, phase equilibrium, etc. will be used for modelling both by hand calculation and with spreadsheets.
Representative process simulation exercises will be used to introduce ASPEN HYSYS.

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					
Face-To-Face	**Blended**	**Fully Online**	**HybridC**	**Hybrid 0**	**Work-Based Learning**
☒	☐	☐	☐	☐	☐
See Guidance Note for details.					

Campus(es) for Module Delivery						
The module will **normally** be offered on the following campuses / or by Distance/Online Learning: (Provided viable student numbers permit) (tick as appropriate)						
Paisley:	Ayr:	Dumfries:	Lanarkshire:	London:	Distance/Online Learning:	Other:
☒	☐	☐	☐	☐	☐	Add name

Term(s) for Module Delivery					
(Provided viable student numbers permit).					
Term 1	☐	Term 2	☒	Term 3	☐

Learning Outcomes: (maximum of 5 statements) **These should take cognisance of the SCQF level descriptors and be at the appropriate level for the module.** At the end of this module the student will be able to:	
L1	To introduce the concept of process modelling and the role of models in the design, optimisation, control and operation of chemical processes.
L2	To introduce problem solving techniques and data analysis in chemical engineering by both analytical and numerical methods.
L3	To develop understanding of process simulation.
L4	To appreciate the importance of physical and thermodynamic data in modelling and simulation of chemical processes.

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 Level **8** Demonstrating a broad and integrated knowledge and understanding of the main areas of process modelling and simulation. Demonstrating a critical understanding of principles, concepts and terminology	
Practice: Applied Knowledge and Understanding	SCQF Level **8** Use a selection of the principal skills, techniques, practices and/or materials associated with engineering and industrial tasks Practice routine selection of suitable thermophysical data for process modelling and simulation.	
Generic Cognitive skills	SCQF Level **8** Be able to compare suggested solutions with expected values	
Communication, ICT and Numeracy Skills	SCQF Level **8** The ability to report in writing and orally on findings Use a range of IT applications to facilitate calculations and provision of report and presentations Interpret, use and evaluate numerical and graphical data and use it to design and analyse equipment and systems	
Autonomy, Accountability and Working with others	SCQF Level **8** Take some responsibility for use of appropriate data resources Practice in ways which take account of own role and responsibilities Work under guidance with qualified practitioners	
Pre-requisites:	Before undertaking this module the student should have undertaken the following:	
	Module Code:	**Module Title:**
	Other:	Any suitable applied math and chemistry background
Co-requisites	**Module Code:** ENGG08022	**Module Title:** Chemical Engineering Fundamentals

*Indicates that module descriptor is not published.

Learning and Teaching	
This module covers a wide variety of theoretical and conceptual areas, which require a range of knowledge and skills to be displayed and exercised. Delivery of its syllabus content involves a diversity of teaching and assessment methods to achieve the learning outcomes of the module. These include formal lectures, structured tutorials (work closely integrated with the lecture material), computer-based exercises to develop process simulation skills and familiarisation with computational techniques for process simulation, completion and submission of written coursework making use of appropriate forms of IT and VLE. The hours for Lecture/Core Content Delivery include the exam and the class tests.	
Learning Activities During completion of this module, the learning activities	**Student Learning Hours** (Normally totalling 200

undertaken to achieve the module learning outcomes are stated below:	hours): (Note: Learning hours include both contact hours and hours spent on other learning activities)
Lecture/Core Content Delivery	24
Tutorial/Synchronous Support Activity	12
Laboratory/Practical Demonstration/Workshop	12
Independent Study	152
	Hours Total 200

****Indicative Resources: (eg. Core text, journals, internet access)**

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

Wiley-VCH (Editor), Ullmann's Modelling and Simulation, Wiley, 2007

Haydary J., Chemical Process Design and Simulation: Aspen Plus and Aspen HYSYS Applications, New York : Wiley, 2019

Rasmuson A., Andersson B., Olsson L., and Ronnie Andersson R., Mathematical Modelling in Chemical Engineering, Cambridge University Press, 2014

Rice R. and Do D., Applied Mathematics and Modelling for Chemical Engineers, 2nd Edition, Wiley-Blackwell, 2012

Stanley M. Walas, Modelling with Differential Equations in Chemical Engineering, Butterworth-Heinemann,1991

(**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.

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.

Please ensure any specific requirements are detailed in this section. Module Co-ordinators should consider the accessibility of their module for groups with protected characteristics..
(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
Assessment Results (Pass/Fail)	Yes ☐No ☒
School Assessment Board	Engineering
Moderator	Cristina Rodriguez
External Examiner	R Ocone
Accreditation Details	This module is part of the BEng (Hons) Chemical Engineering degree programme accredited by the IChemE
Changes/Version Number	2.03 Assessment updated

Assessment: (also refer to Assessment Outcomes Grids below)
Assessment for the module includes both formative and summative assessment. Formative assessment is provided during lectures in the form of class exercise problems, during tutorial sessions, during laboratory sessions and as part of the preparation for written submissions. Summative assessment will be based on the following:
Assessment Category 1 - Unseen Closed Book Class Test worth 50%
Assessment 2 - Continuous assessment worth 50% of the final mark. The continuous assessment component of this module will consist of class-based exercises and simulation exercises. Further details, and the academic calendar when assessment is likely to feature, will be provided within the Module Information Pack.
(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.)

Assessment Outcome Grids (See Guidance Note)

Assessment Type (Footnote B.)	Learning Outcome (1)	Learning Outcome (2)	Learning Outcome (3)	Learning Outcome (4)	Weighting (%) of Assessment Element	Timetabled Contact Hours
Unseen Closed Book Class Test	✓	✓			50	2

Assessment Type (Footnote B.)	Learning Outcome (1)	Learning Outcome (2)	Learning Outcome (3)	Learning Outcome (4)	Weighting (%) of Assessment Element	Timetabled Contact Hours
Laboratory/ Clinical/ Field notebook			✓	✓	50%	12
Combined Total for all Components					100%	14 hours