Module Descriptor

Title	Analysis & Simulation 2		
Session	2025/26	**Status**	Published
Code	ENGG10019	**SCQF Level**	10
Credit Points	20	**ECTS (European Credit Transfer Scheme)**	10
School	**Computing, Engineering and Physical Sciences**		
Module Co-ordinator	O Obeid		

Summary of Module

Computer based analysis and simulation techniques are proving to be ever more critical in their role as enabling technologies in the engineering and design environment. Two particular technologies which are now considered as critical components to any competitive design strategy are Finite Element Analysis (FEA) and Computational Fluid Dynamics (CFD).

This module develops and enhances the students existing knowledge in the FEA and CFD areas. The subject matter focuses strongly on the application of the methods to practical engineering and design problems. The subject content is split to 50% FEA, 50% CFD in terms of time and assessment.

An introduction to more advanced FEA and CFD topics will be provided for the students. The role of these techniques as enabling technologies in a competitive 'time to market' strategy will be discussed and described. The main techniques used for computational analysis of engineering and design problems will be outlined and examples given of typical situations identified. The FEA will build on and reinforce knowledge already obtained in previous FEA modules and the CFD will offer an introduction to the topic.

FEA content will include practical applications. More advanced FEA problems such as heat transfer, dynamic analysis, buckling and simple contact modelling will also be considered.

Practical application of sensitivity studies and a background to optimisation studies are considered. Practical use of optimisation methods, modelling for sensitivity and optimisation (including geometrical) studies and practical selection of design variables will be dealt with and a series of detailed design based finite element case studies presented.

The role of CFD as an enabling technology in a 'time to market strategy' is discussed as well as practical applications for CFD. Theoretical concepts applicable to CFD, boundary conditions, laminar flow modelling and turbulence simulation will all be considered.

An overview of Advanced CFD Applications such as casting simulation, injection moulding/plastic flow simulation will also be outlined.

Quality issues will also be dealt with such as professional organisations associated with finite element practice and other topics such as benchmarking.

Subject matter will be delivered mainly by an innovative programme of laboratory demonstrations where the practical nature of the module will be emphasised and students will gain experience in using state of the art FEA and CFD systems. A complementary series of lectures and presentations will also be used to reinforce the subject matter.

During the course of this module students will develop their UWS Graduate Attributes (https://www.uws.ac.uk/current-students/your-graduate-attributes/). Universal: Academic

attributes - critical thinking and analytical & inquiring mind; Work-Ready: Academic attributes - knowledge of FEA and CFD and relevant ICT skills; Successful : autonomous, driven and resilient.

This module has been reviewed and updated, taking cognisance of the University's Curriculum Framework principles. Examples of this are found within the module such as active and engaging laboratory and digital tutorial activity, module assessment which reflects industry Computer Aided Engineering activities, learning synergies across modules and levels of study, recorded lecture content supporting students to organise their own study time and the use of real-world practical problems with experimental data to validate simulation activity developing digital intelligence meta-skills.

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	Apply a comprehensive knowledge about the role which analysis and simulation systems play in a design and engineering environment to solve complex problems.
L2	Introduce and develop an understanding of the capabilities of analysis and simulation systems with respect to engineering design, particularly finite element analysis and computational fluid dynamics. Recognising the limitations.
L3	Select and apply appropriate computational techniques to model and analyse advanced practical engineering problems
L4	Formulate and analyse complex analytical solutions to more advanced problems using advanced analysis and simulation systems, and to evaluate complex results to reach a substantial conclusion.
L5	N/A

[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

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** A critical knowledge and understanding of finite element / computational fluid dynamics methods and techniques and how these fit into engineering and design strategies. Specific and detailed knowledge and understanding of the application, techniques and practices associated with finite element analysis and computational fluid dynamics analysis of engineering and design problems. Detailed knowledge of the appropriateness of methods and techniques to different problems/scenarios.
Practice: Applied Knowledge and Understanding	**SCQF 10** Applying knowledge and understanding to develop modelling and analysis strategies for a wide range of engineering and design problems, using finite element methods and computational fluid dynamics techniques. Assessing different strategies with respect to obtaining appropriate efficient solutions to engineering and design problems. Making use of specialised finite element and computational fluid dynamic techniques to solve engineering and design problems such as optimisation methods or open ended problems. Select and critically evaluate technical literature and other sources of information to solve complex problems Adopt a holistic and proportionate approach to the mitigation of security risks
Generic Cognitive skills	**SCQF 10** Undertaking, evaluating and assessing critical FE/CFD analysis data. Making judgements on analytical data and results. Being able to develop conceptual solutions and strategies to FE/CFD problems. Dealing with unpredictability in results and making critical comparative assessments between theoretical, simulation, and experimental predictions. Bringing information together from a variety of sources during problem solving and being able to perceive potential problems with methods and strategies.
Communication, ICT and Numeracy Skills	**SCQF 10** Ability to perform, interpret and evaluate complex numerical, geometrical and graphical data and using it to solve problems. Ability to use variables and equations. Ability to integrate existing software with other applications such as spread sheets. Make use of multi-purpose integrated software systems to solve complex problems. Using communications skills to write detailed, critical technical reports, including text and illustration. Using finite element hardware and software and associated ICT equipment and systems such as networks to support and perform a

	wide range of problem solving tasks.
Autonomy, Accountability and Working with Others	**SCQF 10** Identifying and addressing their own learning needs both during and outwith class time. Identifying solution routes and strategies using their own initiative and informed judgements.

Prerequisites	**Module Code**	**Module Title**
	ENGG09020	Design Analysis 2
	ENGG09011	Analysis & Simulation 1
	Other	
Co-requisites	**Module Code**	**Module Title**

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 and teaching for this module comprises a series of lectures and tutorials.	
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	12
Tutorial / Synchronous Support Activity	24
Independent Study	164
n/a	0
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: Finite Element Analysis and CFD System (such as ANSYS and Creo) + 40 seat PC Lab with corresponding network facilities and suitable PCs. Software site licences required. Course notes, presentations and case studies will be provided Textbooks: Chen, X. & Liu, Y. (2019) Finite Element Modeling and Simulation with ANSYS Workbench. Boca Raton: CRC PRESS. Lee, H.H., (2020) Finite element simulations with ANSYS workbench 2020. Mission: SDC publications. Lee, H.H. (2022) Finite element simulations with ANSYS Workbench 2022: theory,

applications, case studies. Mission: SDC publications.

Versteeg, H.K. (2007) An introduction to computational fluid dynamics the finite volume method, 2/E. Chennai: Pearson Education India.

(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. Students will scan their attendance, via the attendance scanners, each time they are on-campus, they will have their attendance recorded in class and they will be expected to login to the VLE several times per week. Students who are unable to attend a timetabled session, due to illness or other circumstance, should notify their Programme Leader. Across the School an 80% attendance threshold is set. Students who fall below this, will be referred to the Student Success Team to see how they can be best supported in their 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. Specialist assistive equipment, support provision and adjustment to assessment practice 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	T Leslie
External Examiner	M Ghaleeh
Accreditation Details	This module is part of the IMechE accredited programmes

	BEng/Meng (Hons) Aircraft and BEng/Meng (Hons) Mechanical Engineering.
Module Appears in CPD catalogue	☐ **Yes** ☒ **No**
Changes / Version Number	2.16 (was 2.15) Module Descriptor copied to 2025/26 template, resources list updated to reflect ILR feedback, Attendance and Engagement and EDI statements updated.

Assessment (also refer to Assessment Outcomes Grids below)
Assessment 1
Assessment Category 1: FEA Essay, Weight-50%
Assessment 2
Assessment Category 2: CFD Essay, Weight-50%
Assessment 3
N/A
(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**
Essay (FEA)	☒	☒	☒	☒	☐	50	0

Component 2							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
Essay (CFD)	☒	☒	☒	☒	☐	50	0

Component 3							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
N/A	☐	☐	☐	☐	☐		
Combined total for all components						100%	0 hours

Change Control

What	**When**	**Who**
Module Descriptor copied to 2025/26	March 2025	Obeid Obeid

template, resources list updated to reflect ILR feedback, Attendance and Engagement and EDI statements updated.		