Module Descriptor

Title	Analysis & Simulation 1		
Session	2025/26	**Status**	Published
Code	ENGG09011	**SCQF Level**	9
Credit Points	20	**ECTS (European Credit Transfer Scheme)**	10
School	**Computing, Engineering and Physical Sciences**		
Module Co-ordinator	O Obeid		

Summary of Module

The role of computer based analysis and simulation techniques are proving to be ever more critical as enabling technologies in the engineering and design environment. Technologies which are now considered as a critical component to any competitive design strategy are Finite Element Analysis (FEA) and Computational Fluid Dynamics (CFD).

This module will introduce students to FEA and CFD focusing strongly on the application of the method to practical engineering and design problems.

An introduction to the FEA and CFD will be given and its role as an enabling technology 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.

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 Computer Aided Engineering 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/CFD and relevant ICT skills; Successful : autonomous, driven and resilient.

FEA Module content will focus on modelling strategies and techniques. Types of modelling such as solid, plane stress and strain techniques, axisymmetric, beam and shell modelling will be discussed and demonstrated.

Modelling issues will be highlighted such as the use of symmetry. Error issues and convergence checking will be dealt with in a practical manner. Comparison will be made of the different formulations used such as p/h methods. Mesh generation and refinement issues will also be dealt with.

CFD Module content will include geometry creation, meshing techniques, solution approaches and post processing of results data. Strategies to demonstrate the importance of mesh independence and turbulence modelling will also be explored.

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	Identify and describe the main techniques utilised for computational analysis and the key stages associated with a basic Finite Element and CFD analysis.
L2	Select and plan suitable modelling and analysis strategies for a typical Finite Element Analysis and CFD analysis.
L3	Define modelling requirements and apply simulation methods to various design problems.
L4	Evaluate the accuracy of a typical analysis and understand and be able to discuss potential sources of errors associated with a simulation.
L5	N/A

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	**SCQF 9** Knowledge and understanding of FEA/CFD and techniques and how it

[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

and U)	fits into engineering and design strategies. Specific knowledge and understanding of the application and practices associated with FEA/CFD of engineering and design problems. Knowledge of the appropriateness of methods and techniques to different problems/scenarios. Knowledge of holistic and proportionate approach to the mitigation of security risks
Practice: Applied Knowledge and Understanding	**SCQF 9** Select and apply appropriate computational and analytical techniques to model complex problems, discussing the limitations of the techniques employed. Applying knowledge and understanding to develop modelling and analysis strategies for a wide range of engineering and design problems, using FEA/CFD. Select and critically evaluate technical literature and other sources of information to solve complex problems. Assessing different strategies with respect to obtaining appropriate efficient solutions to engineering and design problems. Making use of specialised FEA/CFD techniques to solve engineering and design problems such as optimisation methods. Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations. Use practical laboratory and workshop skills to investigate complex problems. mitigations of the techniques employed
Generic Cognitive skills	**SCQF 9** Undertaking and assessing critical analysis data. Making judgements on analytical data and results. Dealing with unpredictability in results and making comparative assessments between theoretical, simulation, and experimental predictions. Bringing information together from a variety of sources during problem solving.
Communication, ICT and Numeracy Skills	**SCQF 9** Ability to perform, interpret and evaluate numerical and graphical data to solve problems. Ability to use variables and equations. Using communications skills to write technical reports, including text and illustration. Using FEA/CFD hardware and software and associated ICT equipment such as networks to support and perform a wide range of problem solving tasks. Adopt a holistic and proportionate approach to the mitigation of security risks. Communicate effectively on complex engineering matters with technical and non- technical audiences, evaluating the effectiveness of the methods used.
Autonomy,	**SCQF 9**

Accountability and Working with Others	Identifying and addressing their own learning needs both during and outwith class time. Identifying solution routes and strategies using their own initiative.

Prerequisites	**Module Code**	**Module Title**
	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 template, resources list updated to reflect ILR feedback, Attendance and Engagement and EDI statements updated.	March 2025	Obeid Obeid
