Wrexham glyndŵr UNIVERSITY

MODULE SPECIFICATION

Module Title:	**Engineering Modelling & Simulation**	**Level**:	6	**Credit Value**:	20

Module code:	ENG685	**Is this a new module?** Yes	**Code of module being replaced**:	ENG619

Cost Centre:	GAME	**JACS3 code**:	H100

Trimester(s) in which to be offered:	1 or 2	**With effect from:**	September 17

School:	Applied Science, Computing & Engineering	**Module Leader:**	S. Monir

Scheduled learning and teaching hours	60 hrs
Guided independent study	140 hrs
Placement	0 hrs
Module duration (total hours)	200 hrs

Programme(s) in which to be offered	Core	Option
BEng (Hons) Aeronautical and Mechanical Engineering	✓	☐
BEng (Hons) Mechanical Manufacturing	✓	
BEng (Hons) Automotive Engineering	✓	
BEng (Hons) Composite Design	✓	
BEng (Hons) Applied Product Design	✓	
BEng (Hons) Drone Technology & Applications	✓	
BEng (Hons) Renewable and Sustainable Engineering	✓	
BEng (Hons) Electrical & Electronic Engineering	✓	
BEng (Hons) Automation Engineering	✓	
BEng (Hons) Optoelectronics and Holography	✓	
BEng (Hons) Aerospace and Modern Optics	✓	

Pre-requisites
None

Office use only

Initial approval February 17

APSC approval of modification Version 1

Have any derogations received Academic Board approval? Yes ☐✓ No ☐

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Derogations
A derogation from regulations has been approved for this programme which means that whilst the pass mark is 40% overall, each element of assessment (where there is more than one assessment) requires a minimum mark of 30%.

Module Aims
• To develop an understanding of the analytical skills and knowledge required in the engineering design process and how it can be improved through the use of engineering modelling and simulations. • This module develops industry-standard software techniques to model and solve specific engineering problems. Typical software examples might be CATIA V5 and ANSYS for Mechanically related programmes, and MATLAB, SIMULINK and VEE for Electrically related programmes.

Intended Learning Outcomes

Key skills for employability

KS1	Written, oral and media communication skills
KS2	Leadership, team working and networking skills
KS3	Opportunity, creativity and problem solving skills
KS4	Information technology skills and digital literacy
KS5	Information management skills
KS6	Research skills
KS7	Intercultural and sustainability skills
KS8	Career management skills
KS9	Learning to learn (managing personal and professional development, self-management)
KS10	Numeracy

At the end of this module, students will be able to		Key Skills	
1	Apply advanced computer modelling and analysis to the solutions of practical and complex design problems.	KS1	KS2
		KS3	KS10
2	Apply and identify critical key stages associated with utilising design parameters in performing complex computer modelling.	KS4	KS5
		KS6	KS10
3	Demonstrate understanding in the use of, and an ability to, produce representative models with proprietary numerical modeling.	KS7	KS8
		KS9	KS10

Assessment:

Assessment One: An individually prepared report for solutions, discussion of results obtained by computer modeling.

Assessment Two: An individual report in which interpretation, specification and implementation of an engineering system is to be analysed through computer modelling simulation.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)	Duration (if exam)	Word count (or equivalent if appropriate)
1	1	Report	50		2000
2	2, 3	Report	50		2000

Learning and Teaching Strategies:

The module will be delivered mainly through lead lectures and student-driven investigative work. It is assumed that the student will have an engineering background and have previously acquired knowledge of solid mechanics & electronic system modelling. The study time will be made up from formal lectures, tutorials and individual study; but also with access to computer laboratory facilities for directed activities. It is expected that the student will regularly access analytical and dynamic software to develop familiarity, understanding and skills as directed by the lecturer. Detailed software tutorial guides will be issued with problems and solutions which will form a foundation for the students' subsequent problem based learning activities. Problems, without tutorial instruction, will then require the student to explore the capabilities of the software. This initial familiarisation will equip the student with the skills necessary to complete any numerical analyses as required in assignment work.

Syllabus outline:

Introduction to Numerical Analysis Techniques

Introduction to numerical analysis techniques: finite element method and the boundary element method. Uniaxial bar elements. Beam elements. Shape functions. Continuum elements. Higher order elements. Accuracy of FEA solutions. Introduction to non-linear FEA.

CAD

3D modelling of complex parts and assemblies. 2D drafting of components and assemblies to international standards. Modelling of mechanisms and rendering. Use of simple FEA analysis workbenches within CAD packages.

FEA applications

Modelling of practical problems, to include subjects such as beam bending, buckling, plate bending etc

CFD modelling

CFD modelling strategies and techniques. Types of models used; 2/3D. Modelling issues; errors, use of symmetry, convergence issue. Comparison of different formulations, mesh generation and refinement, CAD-CFD interaction.

Electronic Design

To develop electronic models and test features to produce electronic designs of high and low frequency circuits using software packages such as Matlab SimScape.

Filter Design

Analogue and Digital Filter design of passive and active filters using software packages such as Matlab, MuliSim and RFSim99.

Mathematical Modelling

To be able to solve equations, such Laplace, Z functions, Eigen vectors and differential equations using Matlab.

Electrical Mechanical Systems

Design and model electrical mechanical systems through software such as Mathworks Multibody or SimScape Mechatronics.

Bibliography:

Essential reading

Ferziger, J. H & Peric, M. (2004) Computational Methods for Fluid Dynamics 3rded, Springer

M.S. Sukhija, T.N. Nagsarkar. (2016) Circuits and Networks: Analysis, Design, and Synthesis, Oxford University Press

Other indicative reading

Megson, T.H.G., Aircraft Structures for Engineering Students, Butterworth-Heinemann; 4th edition, 2007.

Ogata, K., (2010) Modern Control Engineering Pearson International 5th edition.

Archibald, M. (2000) Mechanical Engineering Design with pro/Engineer, Schroff Development

Pope, S. B. (2000) Turbulent flow, Cambridge: University Press.

Riley, P. (2000) Computer Aided Engineering, International Business Press.

Proakis, J.G. and Manolakis, D.G., (1998) Digital Signal Processing Principles Maxwell Mc Millan.

Palm, W.J., (2011) Introduction to Matlab for Engineers, Mc Graw-Hill 3rd edition.

Charles K. Alexander, Matthew N.O. Sadiku (2017), Fundamentals of Electric Circuits, McGraw-Hill