MODULE SPECIFICATION

Module Code:	ENG6AA

Module Title:	Engineering Modelling & Simulation

Level:	6	**Credit Value:**	20

Cost Centre(s):	GAME	JACS3 **code**:	H130 100160

Faculty	FAST	**Module Leader:**	Dr S. Monir

Scheduled learning and teaching hours	30 hrs
Guided independent study	170 hrs
Placement	0 hrs
Module duration (total hours)	200 hrs

Programme(s) in which to be offered (not including exit awards)	Core	Option
BEng (Hons) Industrial Engineering Design (Mechanical)	✓	☐
BEng (Hons) Industrial Engineering Design (Electrical & Electronic)	✓	☐

Pre-requisites
None

Office use only
Initial approval: 11/09/19 Version no:1
With effect from: 11/09/19
Date and details of revision: Version no:2
30/01/20 admin update of derogation

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 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 computer modelling and critical analysis to the solutions of practical and complex design problems.	KS1	KS2
		KS3	KS10
2	Systematically evaluate the key stages associated with utilising design parameters in performing computer modelling.	KS4	KS5
		KS6	KS10
3	Critically analyse the understanding in the use of and an ability to produce representative models with proprietary numerical modelling.	KS7	KS8
		KS9	KS10
4	Professionally document and validate computational models and their results	KS1	KS4

Transferable skills and other attributes

Communication skills
Decision making
Evaluation and analysis skills
Networking
Research skills
Time Management skills
Reflective practice skills

Derogations

A derogation from regulations has been approved for this module 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%.

Assessment:

Indicative Assessment Tasks:

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

Assessment Two: An individual coursework 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 or Word count (or equivalent if appropriate)
1	1, 4	Coursework	50	2000
2	2, 3, 4	Coursework	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.

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 electronics models and test features to produce a high frequency system.

Filter Design

Produce, analyse and test FIR and IIR filter designs.

Mathematical Modelling

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

Bibliography:

Essential reading

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

Other indicative reading

Megson, T.H.G. (2016), *Aircraft Structures for Engineering Students*. 6th ed. Amsterdam: Butterworth-Heinemann/Elsevier.

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

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

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