Wrexham glyndŵr UNIVERSITY

MODULE SPECIFICATION

Module Title:	**Further Engineering Mathematics**	**Level**:	5	**Credit Value**:	20

Module code:	ENG537	**Is this a new module?** No	**Code of module being replaced**:	

Cost Centre:	GAAE	**JACS3 code**:	H100

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

School:	Applied Science, Computing & Engineering	**Module Leader:**	Brian Klaveness

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 & Mechanical Engineering	✓	☐
BEng (Hons) Mechanical Manufacturing	✓	☐
BEng (Hons) Automotive Engineering	✓	☐
BEng (Hons) Drone Technology & Operations	✓	☐
BEng (Hons) Renewable and Sustainable Engineering	✓	☐
BEng (Hons) Electrical & Electronic Engineering	✓	☐
BEng (Hons) Automation Engineering	✓	☐
BEng (Hons) Optoelectronics & 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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Module Aims
• To further develop knowledge of functions suitable for solving a range of mathematical • and engineering problems; • To demonstrate a repertoire of problem-solving skills and an ability to generalise and • transfer ideas, appropriate to engineering applications of mathematical concepts; • To evaluate the solutions found to mathematical and engineering problems; • To develop an ability to analyse experimental data for linear trends and statistical properties; • To analyse and model practical engineering problems using mathematical modelling software.

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	Use partial differentiation for analysing functions of two variables	KS1	KS3
		KS5	KS10
2	Apply mathematical methods of Fourier series and Laplace transform theory to solve engineering problems	KS1	KS3
		KS5	KS10
3	Solve Partial Differential Equations (PDEs)	KS1	KS3
		KS5	KS10
4	Apply complex analysis to engineering applications	KS1	KS3
		KS5	KS10
5	Manipulate linear algebra	KS1	KS3
		KS5	KS10
6	Use statistical methods to collect and analyse data for experimental work, batch production and quality control, including the use of probability to predict performance	KS1	KS3
		KS10	KS4

Transferable/key skills and other attributes
Analyse and solve some mathematical problems relevant to Engineering; Show accurate, coherent and logical thinking in problem solving.

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%.

Assessment:

Assessment One: is by means of an examination covering outcomes 1 and 2. It is an unseen time-constrained one with a fixed number of questions, typically five, where students are required to answer only three out of the five possible.

Assessment Two: is by means of an examination covering outcomes 3,4,5,6. It is an unseen time-constrained one with a fixed number of questions, typically five, where students are required to answer only three out of the five possible.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)	Duration (if exam)	Word count (or equivalent if appropriate)
1	1,2,	Examination	50	2 hrs	
2	3,4,5,6	Examination	50	2 hrs	

Learning and Teaching Strategies:

The module will be presented to students through lectures, tutorials, and computer-based laboratory investigations. The tutorials and computer-based laboratory investigations will be used for students to practice problem solving to reinforce the lecture material and to provide individual attention where needed.

Formative assessment takes place throughout the module during tutorials and feedback is given during these tutorials.

Syllabus outline:

Grounding work: Revision of partial differentiation, total differentials, and partial fractions.

Analyse Functions of Several Variables: Minimum, maximum and saddle points of functions of 2 independent variables. Change of variables, inverse functions and Jacobians.

Define and Apply Fourier Series: Full-range and half-range series. Even and odd functions. Coefficients in exponential form of complex numbers. Elementary properties. Numerical harmonic analysis.

Laplace Transforms: The (one-sided) Laplace transform and its existence, standard functions and use of look-up tables. Use of Laplace transforms in solving simple ODEs with constant coefficients and given boundary conditions. The solution of slightly more complicated ordinary differential equations with given initial or boundary conditions - constant coefficient equations, simultaneous equations, some equations with non-constant coefficients, equations with discontinuous forcing terms.

Solve Partial Differential Equations: Method of separation of variables. Laplace, wave, heat conduction and Schrodinger equations. Initial and boundary value problems. Application of Fourier series to the solution of PDEs.

Apply Complex Numbers to Engineering Applications: Cauchy-Riemann equations. Conformal mappings, bilinear mappings. Impedance and admittance loci. Joukowski transformation. Contour integration, residues.

Linear Algebra:
Matrices and their properties, manipulation and applications, involving determinants, inverses, Gaussian elimination, eigenvalues and eigenvectors. Applications to systems of first order differential equations (control theory). Vector Analysis. Scalar and vector fields. Line integrals and gradient. Double integrals, repeated integrals, surface integrals. Grad, div,curl. Stoke's and Gauss's theorems.

Probability and Statistics
Software: mathematical modelling software to support other elements of this module, emphasising potential as an analytical tool.

Bibliography:

Essential reading

James, G. (2011) *Advanced Modern Engineering Mathematics*, 4th Edn., Harlow: Pearson Education Ltd.

Other indicative reading

Jordan, D. and Smith, P. (2008) *Mathematical Techniques: An Introduction for the Engineering, Physical, and Mathematical Sciences*, 4th Edn., Oxford: Oxford University Press

Kreyszig, E. (2011) *Advanced Engineering Mathematics*, 10th Edn., Chichester: John Wiley and Sons Ltd.

Stroud, K.A. (2011) *Advanced Engineering Mathematics, 5*th Edn., Basingstoke: Palgrave McMillan.