Prifysgol Wrecsam
Wrexham University

Module specification

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Module Code	ENG5AW
Module Title	Further Engineering Mathematics
Level	5
Credit value	20
Faculty	FACE
HECoS Code	100403
Cost Code	GAME
Pre-requisite module	None

Programmes in which module to be offered

Programme title	Core/Optional/Standalone
BEng (Hons) Mechatronics Engineering	Core

Breakdown of module hours

Learning and teaching hours	60 hrs
Placement tutor support hours	0 hrs
Supervised learning hours e.g. practical classes, workshops	0 hrs
Project supervision hours	0 hrs
Active learning and teaching hours total	**0** hrs
Placement hours	0 hrs
Guided independent study hours	140 hrs
Module duration (Total hours)	200 hrs

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.

Module Learning Outcomes

At the end of this module, students will be able to:

1	Apply mathematical methods of Fourier series and Laplace transform theory to solve engineering problems.
2	Apply complex analysis to engineering applications.
3	Solve Partial Differential Equations (PDEs).
4	Apply vector analysis to engineering applications.
5	Manipulate linear algebra.
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.

Assessment

Indicative Assessment Tasks:
This section outlines the type of assessment task the student will be expected to complete as part of the module. More details will be made available in the relevant academic year module handbook.

Assessment 1: A 2-hour examination covering outcomes 1, 2 and 3. It is an unseen time-constrained.

Assessment 2: A 2-hour examination covering outcomes 4, 5, and 6. It is an unseen time-constrained.

Assessment number	Learning Outcomes to be met	Type of assessment	Duration/Word Count	Weighting (%)	Alternative assessment, if applicable
1	1, 2,3	Examination	2 hrs	50%	
2	4, 5, 6	Examination	2 hrs	50%	

Derogations

None

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.

Welsh Elements

Programme is delivered in English and Chinese, however students can submit assessments in Welsh.

Indicative Syllabus Outline

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.

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

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.

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.

Indicative Bibliography

Please note the essential reads and other indicative reading are subject to annual review and update.

Essential Reads:

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, 5th Edn., Basingstoke: Palgrave McMillan.

Administrative Information

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Date and details of revision	22/07/2025 re-validated, revised template, derogation removed
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