# Module specification

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***Refer to the module guidance notes for completion of each section of the specification.***

| | |
|---|---|
| Module code | ENG5AW |
| Module title | Further Engineering Mathematics |
| Level | 5 |
| Credit value | 20 |
| Faculty | FAST |
| Module Leader | Chao Liu |
| HECoS Code | 100403 |
| Cost Code | GAME |

## Programmes in which module to be offered

| Programme title | Is the module core or option for this programme |
|---|---|
| BEng (Hons) Mechatronics Engineering | Core |

## Pre-requisites

None

## Breakdown of module hours

| | |
|---|---|
| Learning and teaching hours | 60 hrs |
| Placement tutor support | 0 hrs |
| Supervised learning e.g. practical classes, workshops | 0 hrs |
| Project supervision (level 6 projects and dissertation modules only) | 0 hrs |
| **Total active learning and teaching hours** | **0** hrs |
| Placement / work based learning | 0 hrs |
| Guided independent study | 140 hrs |
| **Module duration (total hours)** | 200 hrs |

| **For office use only** | |
|---|---|
| Initial approval date | 24/09/2020 |
| With effect from date | 24/09/2020 |

| For office use only | |
|---|---|
| Date and details of revision | |
| Version number | 1 |

## 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

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.

Indicative Assessment Tasks:

Assessment One: is by means of an examination covering outcomes 1, 2 and 3. It is an unseen time-constrained one with a fixed number of questions, typically four, where students are required to answer only three out of the four possible (2 hours).

Assessment Two: is by means of an examination covering outcomes 4, 5, and 6. It is an unseen time-constrained one with a fixed number of questions, typically four, where students are required to answer only three out of the four possible (2 hours).

| Assessment number | Learning Outcomes to be met | Type of assessment | Weighting (%) |
|---|---|---|---|
| 1 | 1, 2, 3 | Examination | 50% |
| 2 | 4, 5, 6 | Examination | 50% |

## 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%.

## 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.

## 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.

## Employability skills – the Glyndŵr Graduate

Each module and programme is designed to cover core Glyndŵr Graduate Attributes with the aim that each Graduate will leave Glyndŵr having achieved key employability skills as part of their study. The following attributes will be covered within this module either through the content or as part of the assessment. The programme is designed to cover all attributes and each module may cover different areas. Click here to read more about the Glyndwr Graduate attributes

**Key Attitudes**
Commitment
Curiosity
Confidence

**Practical Skillsets**
Critical Thinking