Module specification

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

Module code	ENG4AH
Module title	Engineering Mathematics
Level	4
Credit value	20
Faculty	FAST
Module Leader	Shuang 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
Date and details of revision	23/03/22 administrative update to include exam duration

For office use only	
Version number	2

Module aims

To provide a foundation of mathematical knowledge covering a wide range of basic topics and calculus;

To develop an analytical approach to derivation of mathematical functions and expressions;

To develop the application of mathematical principles in the solution of engineering problems, including by means of computer modelling software.

Module Learning Outcomes - at the end of this module, students will be able to:

1	Use algebraic and trigonometric processes to derive and manipulate functions and equations, including scientific notation and significant figures. Plot graphs, including non-linear functions, and calculate their slopes and intercepts.
2	Select and apply appropriate mathematical techniques to the solution of problems.
3	Apply basic statistical analysis.
4	Use differentiation and integration processes including second order differential equations.
5	Use partial differentiation for analysing functions of two variables.
6	Use mathematical modelling software to apply mathematical techniques in solving engineering problems.

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 a 2 hour exam 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.

Assessment Two: is by means of an 2 hour exam 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.

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 calculus component of the module will be presented to the students through a specified series of lectures, supported by problem-solving practice carried out in interactive tutorials. These tutorials will be supported by practice using computer software both in tutorial time and by directed study outside the classroom.

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

Indicative Syllabus Outline

Number systems: Numbers, place value, scientific notation and significant figures. Fractions. Use of calculator;

Algebra: Rules and manipulation of algebraic expressions. Language of derivation (and symbols). Solutions of equations. Introduction to polynomials;

Functions and Graphs: Define function. Plotting and interpreting graphs. Slopes, intersection;

Trigonometric functions;

Powers: indices, exponentials and logarithms;

Graphs: Linear graphs from non-linear functions;

Vector algebra: Addition and subtraction, unit vectors, scalar and vector products;

Statistics: Define and calculate numeric measures of average and spread.

Complex numbers: Different forms and arithmetic, DeMoivre's theorem, powers and roots, relation between trig and hyperbolic functions;

Differentiation: Products, quotients, implicit and parametric differentiation, use of logs for complex products and quotients, partial differentiation, total differentials, and partial fractions, applications;

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

Integration: Methods of substitution, partial fractions and by parts. Definite and indefinite integrals, applications;

First Order Differential equations: Linear first order differential equations; separation of variables, use of integrating factor. Second order with zero input - three types of solutions;

Second Order Differential Equations with Constant Coefficients: Method of undetermined coefficients for finding particular integrals. Transient and steady state solutions. Applications to damped vibrations and resonance. Introduction to finite difference methods for ordinary differential equations;

Applications: Contextualising the application of the topics considered in this module to make them relevant to the chosen technology specialism;

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

Glyn, J. (2015) Modern Engineering Mathematics, 5th Edn, Prentice-Hall.

Other indicative reading

Bird, J. (2010) Engineering Mathematics, 6th Edn, Newnes.

Singh, K. (2011) Engineering Mathematics through Applications, 2nd Edn, Palgrave Macmillan.

Stroud, K. (2007) Engineering Mathematics, 6th Edn., Palgrave Macmillan.

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