Prifysgol Wrecsam
Wrexham University

Module specification

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Module Code	AUR5A6
Module Title	Civil Engineering Maths
Level	5
Credit value	20
Faculty	Faculty of Arts, Computing & Engineering
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) Civil Engineering Degree Apprenticeship	Core
BSc Civil Engineering Studies	Core

Pre-requisites

None

Breakdown of module hours

Learning and teaching hours	40 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	40 hrs
Placement / work-based learning	0 hrs
Guided independent study	160 hrs
Module duration (total hours)	200 hrs

For office use only	
Initial approval date	3rd July 2024
With effect from date	September 2024
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 enable students to apply mathematical principles including algebra, trigonometry, differential equations, calculus and statistics and their relevance to civil engineering, providing a mathematical base for civil engineering theory and application studies.

To develop the ability to use the results of analysis to solve engineering problems, apply technology and implement engineering processes.

To demonstrate problem-solving skills and an ability to generalise and transfer ideas, appropriate to engineering applications of mathematical concepts.

To develop an ability to analyse data for linear trends and statistical properties to provide an understanding of commercial and economic context.

To develop an ability to apply quantitative methods and computer software relevant to their engineering technology discipline.

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

1	Use graphical and numerical methods to solve surveying problems
2	Solve ordinary and partial differential equations Use partial differentiation for analysing functions of two and more variables.
3	Manipulate linear algebra involving matrices, determinants, and their applications
4	Use statistical methods to collect and analyse data for experimental work including the use of probability to predict performance.
5	Use mathematical modelling software (such as MATLAB etc.) to apply mathematical techniques in solving engineering problems.

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 One is by means of an in-class test covering outcomes 1 and 2 (indicative). It is an unseen time-constrained test of 90 minutes with a fixed number of questions.

Assessment Two is by means of an in-class test covering outcomes 3,4 and 5 (indicative). It is an unseen time-constrained test of 90 minutes with a fixed number of questions.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)
1	12	In-class test	50
2	3,4,5	In-class test	50

Derogations

N/A

Learning and Teaching Strategies

The module will be presented to students through lectures and tutorials. An active and inclusive approach is used to engage learners in the topics and will involve individual, group work and flipped learning experiences aligned to the university's Active Learning Framework (ALF). The approach offers students a flexible and adaptive learning experience that can accommodate a range of options that includes both on campus learning and remote learning where appropriate.

The Moodle VLE and other on-line materials and resources will be available to support learning. ALF offers a balance between the classroom elements and digitally enabled activity incorporating flexible and accessible resources and flexible and accessible feedback to support learning.

Tutorials – Close interaction with students ensuring that the work presented during lectures has been understood, with specific help being given to overcome any learning problems, should they occur.

Indicative Syllabus Outline

With reference to applications for Civil Engineering

Graphical and numerical
Trigonometric functions: graphs; sum waves; identities.
Polar Coordinate systems relating to Surveying/ setting out problems.
Numerical analysis/integration using the bisection method and the Newton – Raphson method, mid ordinate, trapezium, and Simpson rule.

Linear Algebra: Matrices and their properties, manipulation, and applications, involving determinants, inverses, Gaussian elimination to solve systems of linear equations.

Differential Equations
Differential equations: modelling using differential equations; solutions (e.g. analytical solutions of linear constant coefficient differential equations, initial and boundary conditions, numerical solutions of differential equations, Euler's method.

First Order Differential Equations

Second Order Differential Equations with Constant Coefficients:

Calculus: partial differentiation; integration; by parts, substitution, and partial fractions: stationary points; Areas and volumes: calculation using definite integrals to solve Construction/Structural/Engineering problems

Statistical techniques: sampling; linear regression (including line of best fit); confidence intervals; discrete and continuous distributions (binomial, Poisson, normal) to provide solutions for material testing/ quality control, forecasting, commercial / economic decision making

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

Stroud, K.A., (2020), *Advanced Engineering Mathematics*, 6th edition. Red Globe Press.

Other indicative reading

Bird, J., (2021) *Bird's Higher Engineering Mathematics*, 9th edition. Routledge.

Attaway, S., (2022) Matlab*: A Practical Introduction to Programming and Problem Solvin*g, 6th edition. Oxford: Butterworth-Heinemann