Module specification

When printed this becomes an uncontrolled document. Please access the Module Directory for the most up to date version by clicking on the following link: Module directory

Module Code	ENG495/AURH495
Module Title	Analytical Engineering Techniques
Level	4
Credit value	20
Faculty	FAST
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) Production Engineering	Core
BEng (Hons) Industrial Engineering Design (Mechanical)	Core
BEng (Hons) Industrial Engineering Design (Electrical & Electronic)	Core
BEng (Hons) Low Carbon Energy, Efficiency and Sustainability	Core
HNC Civil Engineering	Core
FdEng Industrial Engineering (Mechanical) FdEng Industrial Engineering (Manufacturing and Production) FdEng Industrial Engineering (Electrical and Automation)	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	11/09/2019
With effect from date	11/09/2019
Date and details of revision	30/01/20 Admin update of derogation 12/8/20 Temporary change to assessment for 2020/21 post Covid. Approved on 21/09/20 for the addition of BEng Low Carbon Energy, Efficiency and Sustainability Approved on 13/04/21 addition of HNC Civil Engineering, as part of BSc Civil Engineering Studies revalidation 29/06/21 Administrative change to module code 22/9/21 Temporary change to assessment extended for 21/22 Oct 22 minor modification to LO wording through the revalidation and template update Sept 22 addition of FdEng programmes
Version number	7

Module aims

This module is intended to develop an analytical approach to the derivation of mathematical functions and expressions in the solution of engineering problems. Including the use of computer modelling software.

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

1	Apply algebraic and numerical manipulations
2	Manipulate vectors and matrices. Apply complex numbers and be able to find powers and roots of complex numbers
3	Solve first-order differential equations. Ability to interpret solutions and draw conclusions from them
4	Use industry standard IT software which supports engineering applications (such as spreadsheets, MATLAB etc.)

In addition to the module learning outcomes, students will also cover the following accreditation of higher education programme (AHEP) fourth edition learning outcomes: C1, C2 & C3 for BEng Degree Apprenticeship programmes and F1, F2 & F3 for FdEng programmes.

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: A 2-hour examination to cover outcomes 1, 2, and 3. 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: A series of tasks, involving computer software (such as spreadsheets, MATLAB etc.) relating to mathematical engineering problems. Examples of assessments are:

- calculate the area under a curve/the integral of a function by spreadsheet calculation;
- investigate the relationship between given function and its linear transformation by graphing both functions for variety of values;
- solve algebraic/trigonometric equation, return the full solution to an equation; visualize and plot solution.

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

Derogations

A derogation from regulations has been approved for this module 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 practically-based assignments. Half of the time will be devoted to practical investigations and will include the use of computer simulation software.

The tutorials will be used for students to practice problem solving to reinforce the lecture material and to provide individual attention where needed.

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;

Trigonometry: Trigonometric ratios. Solving right- angled triangles using Pythagoras. Trigonometric Rules;

Complex numbers: Different forms and arithmetic, polar and exponential forms, powers and roots;

Vector algebra: Addition and subtraction, scalar multiplication, unit vectors;

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

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

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;

Statistics and Probability: Events and sets, Probability models, Standard probability distributions, e.g. Binomial, Poisson, Normal Distribution and the area under the standard normal curve (z values). Confidence intervals, application to sampling, component and system reliability

Software: Mathematical modelling software to support other elements of this module, emphasizing potential as an analytical tool.

Indicative Bibliography:

Please note the essential reads and other indicative reading are subject to annual review and update. Please *ensure correct referencing format is being followed as per University Harvard Referencing Guidance.*

Essential Reads

Guidance – where possible there should only be one essential text.

J. Bird, *Engineering Mathematics*. 8th ed. London: Routledge, 2017.

Other indicative reading

K. Singh, *Engineering Mathematics through Applications*. 2nd ed. Palgrave Macmillan, 2011.

G. James, *Modern Engineering Mathematics*. 5th ed. Harlow: Pearson, 2015.

S. Attaway, *Matlab: A Practical Introduction to Programming and Problem Solving*, 4th ed. Oxford: Butterworth-Heinemann, 2017.

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.

Guidance, from the following list, delete the attributes that are not covered by this module

Core Attributes
Engaged
Enterprising
Creative
Ethical

Key Attitudes
Commitment
Curiosity
Resilience
Confidence
Adaptability

Practical Skillsets
Digital Fluency
Organisation
Leadership and Team working
Critical Thinking
Emotional Intelligence
Communication