MODULE **DESCRIPTOR**

MODULE TITLE	CALCULUS AND LINEAR ALGEBRA FOR ENGINEERS		
MODULE CODE	EL1902 (L4)	**CREDIT VALUE**	20 CREDITS (10 ECTS)
CAMPUS	UCLAN CYPRUS		
SCHOOL	SCHOOL OF SCIENCE		

MODULE **AIMS**

1. Develop students' knowledge and skills in the use of the techniques of calculus, complex numbers and vector algebra.
2. Develop students' knowledge and skills in the use of the basic concepts and techniques of linear algebra and modelling linear systems with matrices.
3. Give students confidence in developing their own mathematical skills and solving mathematical engineering problems

MODULE **CONTENT**

Module content will typically include:

Functions, Calculus and Complex Numbers:

Functions

Basic properties of circular, exponential and hyperbolic functions and their inverses. Parametric representation of functions.

Vectors

Vectors and scalars; laws of vector algebra. Unit vectors, components of a vector. Scalar and vector products; vector equations of lines and planes as applications. Triple vector products and their geometrical significance.

Calculus

Differentiation: Intuitive idea of a limit, gradient, intuitive idea of derivative, Rules for sum, difference, product and quotient; chain rule; Standard derivatives; Parametric and implicit equations; l' Hopital's rule, Higher derivatives; Maxima and minima; Partial Derivatives.
Integration: Appreciation of the techniques of integration by substitution, parts and partial fractions. Applications to area and volumes, etc.

Complex Numbers

Definition, sum, difference, product and quotient; Argand diagram; Polar form; Products and quotients in polar form; De Moivre's theorem; Elementary complex functions and Euler's formula; Roots of equations.

Linear Systems:

Matrix Operations

Vectors, matrices and matrix-vector operations (addition, multiplication, transpose).
Systems of linear equations: row operations, Gaussian elimination, reduced row echelon form.
Determinants and Cramer's Rule, matrix inverses (via cofactors and determinants).
Eigenvalues and eigenvectors, characteristic equation and characteristic polynomial.
Diagonalisation and inverse matrices.

Matrix Theory

Linear combinations, independence, spanning sets, and bases.
Vector spaces and subspaces, Dimension, Rank-nullity theorem.

Applications of Linear Systems to Engineering problems.

INTENDED **LEARNING OUTCOMES**

On successful completion of this module a student will be able to:	
1.	Display basic knowledge of the properties of the elementary functions of calculus, including trigonometric, exponential and hyperbolic functions and their inverses; Perform and interpret the operations of vector algebra successfully.
2.	Find derivatives of functions of a single variable including parametric and implicit differentiation; apply differentiation to problems of finding and identifying extrema;
3.	Obtain integrals; apply integration to the calculation of areas;
4.	Perform basic complex arithmetic and use de Moivre's theorem as far as the evaluation of the n-th roots of complex numbers;
5.	Perform matrix algebra operations accurately. Apply matrix algebra to solving some systems of linear equations. Calculate the eigenvalues and eigenvectors of matrices.

TEACHING **METHODS**

The class contact will consist of lectures together with workshops. Lectures will introduce the theory and provide examples of its application. Key elements of the learning strategy are regular worksheets in which students are encouraged to practise their mathematical techniques. These will be discussed in the workshops.The module will be assessed principally by examination. However to facilitate and monitor the formative learning process a series of in-class tests/coursework will be set, with diagnosis of any deficiencies students may have in their learning and skills development being fed back during workshops.

ASSESSMENT **METHODS**

The module is assessed through a Portfolio of in-class tests and a written exam.