COURSE DETAILS
Course Code: F11AL
Full Course Title: Applied Linear Algebra
SCQF Level: 11
SCAF Credits: 15
Available as Elective: No

DELIVERY LEVEL
Undergraduate: Yes  Postgraduate Taught: Yes  Postgraduate Research: No
Additional Information:

COURSE AIMS
This course provides a toolkit of modern techniques in applied linear algebra using a combination of background theory with practical applications involving the numerical package Matlab.

LEARNING OUTCOMES – SUBJECT MASTERY
By the end of the course, students should be able to:

- understand the problems of computer arithmetic
- use Matlab for linear algebra
- assess the accuracy of linear algebra algorithms
- assess the computational costs of linear algebra algorithms
- assess the efficiency of linear algebra algorithms

LEARNING OUTCOMES – PERSONAL ABILITIES

- Demonstrate the ability to learn independently
- Demonstrate knowledge of an area of mathematics.
- Manage time, work to deadlines and prioritise workloads

SYLLABUS
Introduction: Scientific computers, floating point arithmetic, floating point operation counts. Introduction to the MATLAB scientific computing package

Convergence: Vector and matrix norms. Condition number and sensitivity of matrix calculations to errors in data. Accuracy and stability of algorithms

Direct methods for linear systems: Gaussian elimination, LU factorisation, pivoting. Using Gaussian elimination to calculate determinants
Special matrices: symmetric, positive definite, banded, sparse. Cholesky and LDLT factorisation.


Orthogonalisation: Gram–Schmidt and modified Gram–Schmidt.

Finding eigenvalues: power and inverse power methods, Gershgorin circle theorem, QR iteration.

Singular value decomposition and applications: pseudo-inverse, pseudo-eigenvalues. Applications in image processing.

Further examples and applications: Solution of linear ODEs, matrix exponential, pseudospectrum.

Solving nonlinear systems of algebraic equations: Newton-type methods.