Liverpool John Moores University

Title:	LINEAR ALGEBRA AND ITS MODELLING APPLICATIONS
Status:	Definitive
Code:	**4002MATHS** (115959)
Version Start Date:	01-08-2016
Owning School/Faculty:	Applied Mathematics
Teaching School/Faculty:	Applied Mathematics

Team	Leader
Paulo Lisboa	Y

Academic Level:	FHEQ4	**Credit Value:**	24	**Total Delivered Hours:**	74
Total Learning Hours:	240	**Private Study:**	166		

Delivery Options
Course typically offered: Standard Year Long

Component	Contact Hours
Lecture	24
Practical	24
Tutorial	24

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Report	AS1	Solution of linear equations using software	15	
Report	AS2	Modelling case studies	45	
Exam	AS3	Examination	40	2

Aims

To provide the basic concepts and techniques of linear algebra.
To develop manipulative skills in matrix algebra.
To utilise appropriate software packages with linear algebra facilities, e.g. DERIVE/MATLAB.

To introduce the ideas of mathematical/statistical modelling and the role of the mathematician/statistician in the solution of 'real-world' problems,

Learning Outcomes

After completing the module the student should be able to:

1 Perform matrix algebra concepts and operations.
2 Solve linear systems of linear algebraic equations, understand the conditions for the existence of solutions.
3 Complete modelling project work in mathematics and statistics using library search, internet search and other means of securing relevant data.
4 Present modelling results in a variety of ways, e.g. written report, oral presentation.
5 Use the software packages such as DERIVE and/or MATLAB to solve problems in the above categories.

Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

Linear equations	5	
Modelling	3	4
Examination	1	2

Outline Syllabus

Matrix algebra concepts. Row spaces, column space, null space, rank, nullity. Echelon and row-reduced echelon form. Special types of matrices: inverse, triangular, diagonal, unity symmetric, skew-symmetric, idempotent, stochastic - practical examples of the occurrence of each.
Methods for solving Linear Systems: Row Reduction, Gaussian elimination.
Matrix Factorisation and application to solving linear systems: LU factorisation.
Iterative methods for solving linear systems: Jacobi and Gauss Siedel methods.
Eigenvalues and eigenvectors, similarity transformations. Markov processes.
Gram-Schmidt orthogonalisation.
Power Method for evaluating Eigenvalues.
Introduction to mathematical modelling; assumptions, problem formulation, development cycle, etc.
Series of three investigative pieces of project work each taking approximately three weeks to complete. The projects will apply the students' knowledge of linear algebra outlined above to modelling problems and introduce them to topics in mathematics and statistics met in detail later in their programmes, e.g. linear programming, finite mathematics for financial mathematics, applied probability, optimisation, etc.

N.B. The syllabus will be supported throughout with the software DERIVE and/or MATLAB.

Learning Activities

Lectures, tutorials and laboratory based used of mathematical software to solve linear algebra problems.
Mathematical and statistical modelling of case studies in areas of finance, engineering and statistics, each of which involves computer practical work, report writing and/or oral presentation of outcomes.

Notes

This module provides students with the experience of using pencil-and-paper techniques and mathematical software to solve realistic problems in Linear Algebra and modelling applications.