H6LA: Linear Algebra

Module Code:	H6LA
Long Title	Linear Algebra APPROVED
Title	Linear Algebra
Module Level:	LEVEL 6
EQF Level:	5
EHEA Level:	Short Cycle
Credits:	5
Module Coordinator:	MICHAEL BRADFORD
Module Author:	MICHAEL BRADFORD
Departments:	School of Computing
Specifications of the qualifications and experience required of staff	Master's degree in mathematics, computing or cognate discipline. May have industry experience also.

Learning Outcomes

On successful completion of this module the learner will be able to:

#	Learning Outcome Description
LO1	Apply matrix algebra operations and investigate properties of matrices.
LO2	Define vector spaces and describe the structure of vector spaces in terms of linear independence, basis, and dimension.
LO3	Examine qualitative and quantitative aspects (e.g., such as norm and orthogonality) of vector spaces when presented as inner product spaces.
LO4	Determine if a system of linear simultaneous equations can be solved and if so provide a solution.
LO5	Describe the properties of linear transformations and determine how such transformations can be represented by matrices.
LO6	Investigate and apply coordinate free representations of linear transformations using Geometric Algebra.

Dependencies

Module Recommendations

No recommendations listed

Co-requisite Modules

No Co-requisite modules listed

Entry requirements	Learners should have attained the knowledge, skills and competence gained from stage 1 of the BSc (Hons) in Data Science

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Module Content & Assessment

Indicative Content
Matrix Algebra Motivation and Context. Linear Equations. Matrix Operations. Types of Matrices
Matrix Algebra Trace of a Matrix. Matrix Inversion.
Matrix Algebra Permutations. Determinants. Minors and Cofactors
Vector Spaces Definitions and examples. Linear Dependence. Basis and Dimension
Vector Spaces Inner Product Spaces. Norms
Vector Spaces Othogonalization. Linear Simultaneous Equations. Gaussian Elimination
Linear Transformations Properties of Linear Transformations . Matrix Representation
Linear Transformations Change of Basis. Eigenvalues and Eigenvectors. Characteristic and Minimal Polynomials
Linear Transformations Cayley-Hamilton Theorem. Singular Value Decomposition
Introduction to Geometric Algebra Motivation and Context. Axioms of Geometric Algebra. Vectors and Scalars. The Geometric Product
Introduction to Geometric Algebra Analytical Geometry. Multivectors
Introduction to Geometric Algebra Linear Transformations. Applications

Assessment Breakdown	%
Coursework	40.00%
End of Module Assessment	60.00%

Assessments

Full Time

Coursework

Assessment Type:	Continuous Assessment	**% of total:**	Non-Marked
Assessment Date:	n/a	**Outcome addressed:**	1,2,3,4,5,6
Non-Marked:	Yes		

Assessment Description:
Ongoing independent and group class activities and feedback.

Assessment Type:	Continuous Assessment	**% of total:**	40
Assessment Date:	n/a	**Outcome addressed:**	1,2,3,4,5,6
Non-Marked:	No		

Assessment Description:
A comprehensive set of questions relating to Matrix Algebra, Vector Spaces, Linear Transformations, and Geometric Algebra.

Assessment Type:	Easter Examination	**% of total:**	60
Assessment Date:	n/a	**Outcome addressed:**	1,2,3,4,5,6
Non-Marked:	No		

Assessment Description:
Written examination with questions from all module topic areas.

No End of Module Assessment

No Workplace Assessment

Reassessment Requirement

Repeat examination
Reassessment of this module will consist of a repeat examination. It is possible that there will also be a requirement to be reassessed in a coursework element.

Reassessment Description
The repeat strategy for this module is an examination. All learning outcomes will be assessed in the repeat exam.

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Module Workload

Module Target Workload Hours 0 Hours

Workload: Full Time

Workload Type	*Workload Description*	*Hours*	*Frequency*	*Average Weekly Learner Workload*
Lecture	Classroom & Demonstrations (hours)	24	Per Semester	2.00
Tutorial	Other hours (Practical/Tutorial)	12	Per Semester	1.00
Independent Learning	Independent learning (hours)	89	Per Semester	7.42
			Total Weekly Contact Hours	3.00

Module Resources

Recommended Book Resources

Strang, G.. (2016), Introduction to Linear Algebra (5th ed), Wellesley-Cambridge Press.

Lipschutz, S. & Lipson M.. (2012), Schaum's Outline of Linear Algebra (5th ed), McGraw Hill Education.

Dorst, L., Fontijne D. & Mann S.. (2009), Geometric Algebra for Computer Science: An Object-Oriented Approach to Geometry (2nd ed), Morgan Kaufmann.

Supplementary Book Resources

Datta, K. B.. (2016), Matrix and Linear Algebra: Aided with MATLAB (3rd ed), Prentice-Hall of India Pvt Ltd.

Anton, H.. (2013), Elementary Linear Algebra (11th ed), Wiley.

Hestenes, D.. (2008), New Foundations for Classical Mechanics (2nd ed), Springer.

This module does not have any article/paper resources

Other Resources

[Website], MIT Open Course Ware, Massachusetts Institute of Technology. Linear Algebra Lecture Series by Gilbert Strang @ https://ocw.mit.edu/courses/mathematics/ 18-06-linear-algebra-spring-2010/.

[Website], University of Cambridge, Geometric Algebra Lecture Series by Chris Doran @ http://geometry.mrao.cam.ac.uk/2016/10/g eometric-algebra-2016/.

Discussion Note:	