

Course Unit	Linear Algebra	Field of study	Mathematical and Quantitative Methods
Bachelor in	Informatics and Communications	School	School of Public Management, Communication and Tourism
Academic Year	2022/2023	Year of study	1
Type	Semestral	Semester	1
Level	1-1	ECTS credits	6.0
Code	9188-320-1101-00-22		
Workload (hours)	162	Contact hours	T - TP 60 PL - TC - S - E - OT 20 O -

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s) Ana Ester Veiga Rodrigues

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:

1. perform the elementary operations of matrix algebra and solve matricial equations and identify special matrices;
2. check if a matrix is invertible and calculate its inverse;
3. classify and solve systems of linear equations, in matrix notation, using the methods of Gauss, Gauss-Jordan and Cramer;
4. identify if a set, V , can be given a structure of vector space over a field of the real numbers, \mathbb{R} ;
5. determine if a given subset M of V is a vector subspace of V (over \mathbb{R});
6. identify if a given transformation between two vector spaces is linear, and determine the matrix of a linear transformation using the canonical basis of both spaces;
7. calculate the kernel and the range of a linear transformation.

Prerequisites

Before the course unit the learner is expected to be able to: perform the basic operations of elementary calculus.

Course contents

Matrices. Systems of linear equations. Determinants. Vector Spaces. Linear transformations.

Course contents (extended version)

1. Matrices
 - Definition, terminology and notation.
 - Matrix operations.
 - Rules of matrix arithmetic.
 - Matrix inversion.
 - Triangular, diagonal and symmetric matrices.
2. Systems of Linear Equations
 - Linear systems in matrix notation.
 - Gaussian elimination. Method of Gauss-Jordan.
 - Consistency of linear systems.
 - Homogeneous and nonhomogeneous linear systems.
 - Systems of linear equations and matrix inversion.
3. Determinants
 - Definition and properties of determinants.
 - Evaluation of determinants by row reduction.
 - Cramer's rule.
 - Evaluation of determinants by cofactor expansion.
 - The adjoint matrix.
4. Vector Spaces
 - Vector spaces and subspaces.
 - Linear independence, basis and dimension.
 - Column space, row space and null space.
 - n -dimensional Euclidean vector space.
 - Norm, dot product and projections in \mathbb{R}^n .
 - Cross product in \mathbb{R}^3 .
 - Area of a paralelogram. Volume of paralelepiped
5. Linear Transformations
 - Linear transformations between general real vector spaces.
 - Kernel and range of a linear transformation.
 - Inverse linear transformations.
 - Matrix of a linear transformation.

Recommended reading

1. Anton, H. & Rorres, C. (2010). Elementary Linear Algebra with Applications, 10th ed. , Wiley. ISBN: 0470432055
2. Barbedo, I. (2017). Apontamentos de Álgebra Linear e Álgebra Linear e Geometria Analítica, EsACT
3. Lay, D. C. (2012). Linear Algebra and Its Applications. (4th ed.) Addison-Wesley. ISBN: 9780321385178
4. Poole, D. (2011). Linear Algebra- A Modern Introduction. (3rd ed.) Brooks/Cole CENGAGE Learning. ISBN: 9780538735445
5. Strang, G. (2005). Linear Algebra and Its Applications, 4th ed. , Brooks Cole. ISBN: 0030105676

Teaching and learning methods

Course contents will be introduced in lectures. Complementary, there will be tutorial classes where the students are guided in the accomplishment of practical exercises focusing on applications of theoretical concepts. Also, will be assigned individual homework. At the end of each subject there will be an individual evaluation.

Assessment methods

1. Distributed evaluation - (Regular, Student Worker) (Final, Supplementary)
 - Intermediate Written Test - 50%
 - Final Written Exam - 50%
2. Final evaluation - (Regular, Student Worker) (Final, Supplementary, Special)

Assessment methods

- Final Written Exam - 100%

Language of instruction

Portuguese

Electronic validation

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06-10-2022	09-10-2022	10-10-2022	14-10-2022