INSTITUTO POLITÉCNICO DE BRAGANÇA

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	2023/2024	Year of study	1	Level	1-1	ECTS credits	6.0
Type	Semestral	Semester	1	Code	9188-320-1101-00-23		

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): Mara Cristina Sarmento Dias

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, IR;
5. determine if a given subset M of V is a vector subspace of V (over IR);
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, terminoloy 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 IR^n.
   - Cross product in IR^3.
   - Area of a paralelogram. Volume of parallelepiped
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.

Assessment methods

1. Continuous evaluation - (Regular, Student Worker) (Final)
   - Intermediate Written Test - 50%
   - Intermediate Written Test - 50%
2. Final evaluation - (Regular, Student Worker) (Final, Supplementary, Special)
   - Final Written Exam - 100%

Language of instruction

Portuguese

Electronic validation

Mara Cristina Sarmento Dias	Vítor José Domingues Mendonça	Anabela Neves Alves de Pinho	Luisa Margarida Barata Lopes
19-10-2023	25-10-2023	25-10-2023	01-11-2023