ADEM
Área Departamental de Engenharia Mecânica

Sheet Course ()

Course	FIRST CYCLE IN MECHANICAL ENGINEERING		
Unit	Applied Linear Algebra	Mandatory	☒
		Optional	☐
Unit scientific area	Mathematics	Category	B

Unit category: B - Basic; C - Core Engineering; E - Specialization; P - Complementary.

Year: 1st	Semester: 1st		ECTS: 6,0		Hours: 4,5
Contact time	T: 67,5	TP: 67,5	PL:	S:	OT:

T - Lectures; TP - Theory and practice; PL - Lab Work; S - Seminar; OT - Tutorial Guidance.

Unit Director	Title	Position
Cátia Dias	Ph.D.	Assistant Professor

Learning Objectives (knowledge, skills and competences to be developed by students)

(max. 1000 characters)

In this CU, students learn the fundamentals of Linear Algebra and Analytical Geometry. A student who obtains a passing grade should be able to:

1. Perform calculations with matrices and determinants.

2. Analyse and solve systems of linear equations.

3. Understand the concepts of vector space and linear transformation and be able to apply them to solve problems.

4. Compute eigenvalues and eigenvectors and diagonalize matrices.

5. Compute inner, cross and scalar triple products, and understand their geometric interpretation.

6. Apply the concepts learned to the solution of problems in analytical geometry.

7. Apply the knowledge learned in the course to the solution of problems in engineering.

Syllabus

(max. 1000 characters)

Matrices. Definition and notation. Matrix operations. Echelon form and rank of a matrix. Systems of linear equation. Inverse of a matrix.

Determinants: definition and examples. Properties. Methods of evaluating determinants.

Vector spaces. Axiomatic definition and examples. Subspaces. Generating sets. Linear dependence. Basis and dimension. Change of basis.

Linear transformations. Definition and examples. Matrix representation of a linear transformation. Kernel and image of a linear transformation. Operations with linear transformations.

Eigenvalues and eigenvectors. Definition and examples. Eigenspaces. Algebraic and geometric multiplicity of na eigenvalue. Diagonalization.

Euclidean spaces. Inner product. Axiomatic definition and examples. Norm, distance, angle. The cross product and the scalar triple product. Geometrical applications.

Analytical Geometry. Analytical representation of straight lines and planes. Conics and quadrics.

Demonstration of consistency of the syllabus with the objectives of the course

(max. 1000 characters)

The syllabus contains the usual tools required to solve linear problems (matrices, determinants and eigenvalue theory) and the basic examples where these tools are applied (solution of linear systems, linear maps and analytical geometry problems).

Teaching methodology (evaluation included)

(max. 1000 characters)

Lectures where the material in the syllabus is explained, illustrative examples are presented and a portion of the time is devoted to problem solving.

Continuous assessment: Continuous assessment consists of two partial tests with a minimum grade of eight values and can be complemented by assignments, with a maximum grade of one value, and the final grade can not exceed twenty values. In order to pass the student must score at least 8 points (out of 20) in each exam and average at least 10 point. One of the mid-term exams can be repeated on the date of the first final exam.

Final exams: In order to pass, a student must obtain a grade of at least 10 points (out of 20) in a final exam.

Demonstration of consistency of teaching methods with the learning objectives of the course (max. 3000 characters)
The format of the lectures allows the teacher to explain the theory of linear algebra concisely and simultaneously illustrate how the theory is applied in the solution of typical problems.

Main Bibliography (max. 1000 characters)	
1.	Anton, Rorres, Álgebra Linear com Aplicações, Bookman
2.	David Lay, Linear , Algebra and its Applications, Pearson, Addison Wesley.
3.	A. Steinbruch e P. Winterle, Álgebra Linear, McGraw Hill
4.	G. Strang, Linear Algebra and its Applications, HBJ Publishers.
5.	S. Blyth e E. F. Robertson, Basic Linear Algebra, Springer.
6.	E. Giraldes, V. H. Fernandes, M. P. Marques, Álgebra Linear e Geometria Analítica, Mc Graw Hill.