

Course guide 230451 - ALG - Linear Algebra and Geometry

Last modified: 03/06/2024

Unit in charge:	Barcelona School of Telecommunications Engineering		
Teaching unit:	749 - MAT - Department of Mathematics.		
Degree:	BACHELOR'S DEGREE IN ENGINEERING PHYSICS (Syllabus 2011). (Compulsory subject).		
Academic year: 2024	ECTS Credits: 6.0	Languages: Catalan	

LECTURER

Coordinating lecturer:	MARTA CASANELLAS RIUS
Others:	Primer quadrimestre:
	MARTA CASANELLAS RIUS - 10
	BERNAT PLANS BERENGUER - 10

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

1. Ability to solve math problems that may arise in engineering. Ability to apply knowledge about linear algebra, geometry, differential geometry, differential and integral calculus, ordinary and partial differential equations, probability and statistics.

2. Ability to select numerical and optimization methods suitable for solving physical and engineering problems. Ability to apply the knowledge of numerical algorithms and optimization.

Generical:

2. ABILITY TO IDENTIFY, FORMULATE, AND SOLVE PHYSICAL ENGINEERING PROBLEMS. Planning and solving physical engineering problems with initiative, making decisions and with creativity. Developing methods of analysis and problem solving in a systematic and creative way.

Transversal:

1. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 1. Planning oral communication, answering questions properly and writing straightforward texts that are spelt correctly and are grammatically coherent.

3. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

TEACHING METHODOLOGY

We will give 3 hours a week of Theory classes and 2 hours a week of Problem Sessions.

LEARNING OBJECTIVES OF THE SUBJECT

Good knowledge of: -Vector Spaces. -Matrix Calculus. -Linear maps. -Diagonalization process. -Scalar products and Euclidean spaces. -Spectral theorem and Singular value decomposition



STUDY LOAD

Туре	Hours	Percentage
Hours large group	65,0	43.33
Self study	85,0	56.67

Total learning time: 150 h

CONTENTS

1. Vector Spaces

Description:

Fields. The field of complex numbers. Polynomials and factorizations. Vector spaces. Linear combinatios, independence. Basis and dimensions. Subspaces, sum, intersection and complementary subspaces. Ranks o matrices. Linear systems. The Rouché-Frobenius theorem. Determinants.

Full-or-part-time: 32h

Theory classes: 7h Practical classes: 8h Guided activities: 4h Self study : 13h

2. Linear maps

Description:

Linear maps. Kernel and Image. Injective, surjective and bijective morphisms. Matrix of a linear map. Invariant subspaces.

Full-or-part-time: 28h Theory classes: 7h Practical classes: 4h Guided activities: 4h Self study : 13h

3. Diagonalization

Description:

Eigenvectors and eigenvalues. Characteristic polinomial. Diagonalization criterium. Aplications

Full-or-part-time: 30h

Theory classes: 8h Practical classes: 5h Guided activities: 4h Self study : 13h



4. Euclidian spaces

Description:

Bilinear forms. Inner product, norm and angle. Euclidian and unitary space space. Orthonomal basis. Gramm-Schmidt theorem. Projection theorem. Orthogonal matrices and unitary matrices. Spectral theorem. Singular value decomposition and fundamental theorem of linear algebra. Isometries.

Full-or-part-time: 29h Theory classes: 8h Practical classes: 4h Guided activities: 4h Self study : 13h

GRADING SYSTEM

We will do a mid-term exam (EP) and also evaluate a delivery or a short test at Problem sessions (P). The Final Exam (EF) containcs both practical exercisis and theoretical problems.

NF=màx {0.3 EP + 0,05 P + 0.65 EF, EF}

The Final Exam (EF) is reassessable. The other two parts (EP and P) are not.

EXAMINATION RULES.

In the exams (partial and final) the student cannot take any type of material or notes.

BIBLIOGRAPHY

Basic:

- Castellet, M.; Llerena, I. Àlgebra lineal i geometria. 4a ed. Bellaterra: Publicacions de la UAB, 2000. ISBN 847488943X.

- Hernández Rodríguez, E.; Vàzquez Gallo, M.J.; Zurro Moro, M.A. Álgebra lineal y geometría [on line]. 3a ed. Madrid: Pearson, 2012 [Consultation: 27/10/2020]. Available on:

http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=1210. ISBN 9788478291298.

- Poole, David. Linear algebra : a modern introduction. Fourth edition. Stamford: Cengage Learning, [2015]. ISBN 9781285463247.

Complementary:

- Audin, M. Geometry. Berlin: Springer Verlag, 2003. ISBN 3540434984.