Linear Algebra

Academic Year: (2016 / 2017) **Review date: 01-09-2016**

Department assigned to the subject: Mathematics Department

Coordinating teacher: SANCHEZ SANCHEZ, ANGEL

Type: Basic Core ECTS Credits : 6.0

Year : 1 Semester : 1

Branch of knowledge: Engineering and Architecture

OBJECTIVES

The student will adquire the basic concepts of
1. Linear systems.
2. Matrix and vector algebra.
3. Linear subspaces in Rn.
4. Complex numbers.

The student will adquire the following skills:
1. To compute the solution of a linear system of equations
2. To decide the uniqueness and existence of the solution of a linear system of equations
3. To work with vectors and matrices
4. To compute the inverse of a matrix
5. To compute bases of linear subespaces
6. To compute eigenvalues and eigenvectors of a matrix
7. To compute an orthonormal basis
8. To solve least square problems
9. To diagonalize symmetric matrices through orthogonal transformations.

DESCRIPTION OF CONTENTS: PROGRAMME

Lecture 0. Introduction to complex numbers.
0.1 Definition. Sum and product.
0.2 Conjugate, modulus, and argument.
0.3 Complex exponential.
0.4 Powers and roots of complex numbers.
Lecture 1. Systems of linear equations.
1.1. Systems of linear equations.
1.2. Row reduction and echelon forms.
1.3. Vector equations.
1.4. The matrix equation Ax=b.
1.5. Structure of the solution space of a system of linear equations.
1.6. Linear independence.
1.7. Introduction to linear mappings.
1.8. The matrix of a linear mapping.
Lecture 2. Matrix algebra.
2.1. Matrix operations.
2.2. Inverse of a matrix.
2.3. Block-partitioned matrices.
Lecture 3. Determinants.
3.1. Introduction to determinants.
3.2. Properties of determinants.
Lecture 4. Vector spaces.
4.1. Subspaces in Rn.
4.2. Kernel and column space of a matrix.
4.3. Bases in Rn and in subspaces.
4.4. Systems of coordinates.
4.5. Dimension of a vector space.
4.6. Rank.
4.7. Change of basis.
Lecture 5. Eigenvalues and eigenvectors.

5.1. Eigenvalues and eigenvectors.
5.2. The characteristic equation.
5.3. Diagonalization of matrices.
Lecture 6. Orthogonality and least-squares problems.
6.1. Inner product, norm and orthogonality.
6.2. Orthogonal sets.
6.3. Orthogonal projections.
6.4. The Gram-Schmidt method and the QR factorization.
6.5. Least-squares problems.
Lecture 7. Symmetric matrices.
7.1. Diagonalization of symmetric matrices.

LEARNING ACTIVITIES AND METHODOLOGY

- Theory classes in large groups: Basic theoretical knowledge and skills will be presented. A textbook will be followed (Linear Algebra and Its Applications, by David C. Lay). The course chronogram will be available in advance to the students to allow them to prepare the classes in advance.
- Problem solving classes in small groups.
- Solving problems by the student.
- The teacher may propose additional homework to be done either individually or in group.

ASSESSMENT SYSTEM

1- Continuous evaluation. There will be three partial tests (see the chronogram). They will test the acquisition of basic skills and concepts by the student. Its percentage in the final grade will be 40%.
2- Final test. It will test the global knowledge of the student of the subject. Its percentage in the final grade will be 60%.
3- Extra test. Those students who have not passed the subject in the regular period will have the opportunity to do an extra final test. Its percentage in the grade will be 100%, although for those students who did the partial tests in the regular period, the same rules as in the regular period will be applied, whenever this improves the grade of the extra test.

% end-of-term-examination:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

BASIC BIBLIOGRAPHY

- David C. Lay Linear Algebra and its Applications 4th edition, Pearson, 2012.

ADDITIONAL BIBLIOGRAPHY

- B. Noble and J. W. Daniel Applied Linear Algebra, 3rd Edition, Prentice Hall, 1988.
- G. Strang. Linear Algebra and its applications, 4th ed., Wellesley, Cambridge,, 2006
- L. Spence, A. Insel y S. Friedberg Elementary Linear Algebra. A Matrix Approach, Prentice Hall 2000.