Linear Geometry

Academic Year: (2019 / 2020) **Review date: 14-05-2020**

Department assigned to the subject: Mathematics Department

Coordinating teacher: SANZ SERNA, JESUS MARIA

Type: Basic Core ECTS Credits : 6.0

Year : 1 Semester : 2

Branch of knowledge: Engineering and Architecture

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Fundamentals of Algebra, Linear Algebra, Differential Calculus

OBJECTIVES

1. Students have shown that they know and understand the mathematical language and the abstract-rigorous reasoning, as well as to apply them to state and prove precise results in several areas of mathematics.
2. Students have shown that they understand the fundamental results of linear algebra, matrix theory and linear geometry concerning spectral theory of matrices and linear transformations, symmetric and Hermitian matrices, affine spaces and projective geometry.
3. Students are able to use techniques from linear algebra, matrix theory and linear geometry to construct mathematical models of processes that appear in real world applications.
4. Students are able to communicate, in a precise and clear manner, ideas, problems and solutions related to linear algebra, matrix theory and linear geometry to any kind of audience (specialist or not).

DESCRIPTION OF CONTENTS: PROGRAMME

1. Eigenvalues and eigenvectors: diagonalization of matrices and Schur's triangularization
2. The Jordan canonical form
3. Normal matrices and their spectral theorem
4. Positive definite matrices
5. Bilinear and quadratic forms
6. The singular value decomposition
7. Affine spaces and their applications
8. Affine transformations
9. Projective geometry and its applications
10. Conic sections and quadric surfaces

LEARNING ACTIVITIES AND METHODOLOGY

1. THEORETICAL-PRACTICAL CLASSES, where the knowledge that the students must acquire is explained and developed. Students will have basic reference texts to facilitate the understanding of the classes and the development of follow up work. The teacher and the students will solve exercises and practical problems, previously suggested by the teacher. There will be mid term tests for evaluating the competences and skills acquired by the students and for helping the students to improve their learning strategies.

2. TUTORING SESSIONS. Individualized attendance for students with a teacher for at least two hours a week.

3. STUDENT INDIVIDUAL OR GROUP WORK. Each student's individualized study, understanding of results and proofs, and exercise and problem solving is fundamental in mathematics, both for learning and for self-evaluation of acquired competences and skills. Solving exercises and problems and discussing theoretical results inside small groups of students is an excellent complementary activity for

improving the learning.

ASSESSMENT SYSTEM

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

- Continuous evaluation: It corresponds to 40% of the final mark. It consists of two mid-term exams held along the course to assess the student's progression. Continuous evaluation also allows students themselves to modify their learning strategies, in case it is necessary.

- Final end-of-term exam: It corresponds to 60% of the final mark. It allows to assess the student's general understanding of the subject.

BASIC BIBLIOGRAPHY

- C.D. Meyer Matrix Analysis and Applied Linear Algebra, SIAM, 2000
- D.C. Lay, S.R. Lay and J.J. McDonald Linear Algebra and its Applications, 5th edition, Pearson, 2016
- G. Strang Introduction to Linear Algebra, Wellesley-Cambridge Press, 2016
- O. Faugeras Three Dimensional Computer Vision, A Geometric Viewpoint, The MIT Press, 1993
- S.R. García and R.A. Horn A Second Course in Linear Algebra, Cambridge University Press, 2017

ADDITIONAL BIBLIOGRAPHY

- B. Noble and J.W. Daniel Applied Linear Algebra, Prentice-Hall Int., 1988
- E. Outerelo Domínguez y J.M. Sánchez Abril Nociones de Geometría Proyectiva, Sanz y Torres, 2009
- P. Lancaster and M. Tismenetsky The Theory of Matrices with Applications, 2nd edition, Academic Press, Inc., 1985
- R.A. Horn and C.R. Johnson Matrix Analysis, 2nd edition, Cambridge University Press, 2013