

**COURSE DATA****Data Subject**

Code	34155
Name	Lineal algebra and geometry II
Cycle	Grade
ECTS Credits	9.0
Academic year	2020 - 2021

Study (s)

Degree	Center	Acad. year	Period
1107 - Degree in Mathematics	Faculty of Mathematics	2	Second term

Subject-matter

Degree	Subject-matter	Character
1107 - Degree in Mathematics	5 - Linear algebra and geometry	Obligatory

Coordination

Name	Department
ESTEBAN ROMERO, RAMON	363 - Mathematics

SUMMARY

The conducting thread of this subject is the study of the concepts of linear or quadratic algebra that are invariant under a reference change for further applications, especially to the Euclidean affine space.

In Linear Algebra it is natural to refer the concepts (linear and bilinear maps, scalar products,...) to bases, because their behaviour on bases allows us to deduce properties of their behaviour on each element. This leads us to a matrix algebra.

However, the geometric-linear concepts are independent on the bases they are referred to.

Therefore we must analyse what happens when the basis, or the reference system of an affine space is considered, is changed.



We treat the following topics:

- 1.- Given a vector space the common properties of the coordinate matrices of the same endomorphism are characterised. In particular, we give a characterisation of the conjugacy classes of automorphisms of a vector space.
2. When the vector space has an Euclidean metric, it has an orthonormal basis, and the transformations preserving the metric are interesting, that is, the isometries and how a change of orthonormal basis affects the analytic expression of each Euclidean structure/map.
- 3.- The third part of the programme deepens into the study of the Euclidean affine space, which is the space that better approximates the ordinary geometry and physics.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

To have studied the subject of Linear algebra and geometry I. Moreover, it is convenient that the student has also followed the subject of Algebraic structures.

OUTCOMES

1107 - Degree in Mathematics

- Capacity for analysis and synthesis.
- Capacity for criticism.
- Solve problems that require the use of mathematical tools.
- Learn autonomously.
- Possess and understand the mathematical knowledge.
- Expressing mathematically in a rigorous and clear manner.
- Reason logically and identify errors in the procedures.
- Capacity of abstraction and modeling.



- Knowing the time and the historical context in which occurred the great contributions of women and men in the development of mathematics.
- Visualize and interpret the solutions obtained.

LEARNING OUTCOMES

- To recognise the diagonalisable endomorphisms and matrices.
- To dominate the calculation of the canonical forms of the endomorphisms of vector spaces of low dimension.
- To dominate the calculation of the orthogonal complement subspaces.
- To dominate the calculation of the canonical forms of symmetric and orthogonal endomorphisms.
- To recognise the Euclidean affine space as an adequate model for metric geometry.
- To dominate the techniques of metric calculations in low dimensions.
- To dominate the classification of movements and quadrics in Euclidean affine spaces of low.

DESCRIPTION OF CONTENTS

1. Preliminaries

2. Endomorphism theory. Canonical forms. Invariant factors. Elementary divisors.

3. Matrices over $K[x]$

4. Orthogonal congruence in symmetric and orthogonal matrices.

5. Metric classification of the movements of an Euclidean affine space.

**6. Quadrics and conics. Metric classification.****WORKLOAD**

ACTIVITY	Hours	% To be attended
Theory classes	56,00	100
Classroom practices	34,00	100
Other activities	11,00	100
Preparation of evaluation activities	24,00	0
Preparing lectures	50,00	0
Preparation of practical classes and problem	50,00	0
TOTAL	225,00	

TEACHING METHODOLOGY

The presencial work will consist basicly i the attendance to magistral lectures given by the teacher in charge of this part of the teaching.

Special attention will be paid to the motivation of the interventions of the students by motivating and solving questions.

The practical presencial lectures will have two times: one in which the teacher solves some "typical" or "motivating" problem and another one in which the students, working in groups, solve the problems assigned by the teacher.

EVALUATION

The assessment of the learning of the knowledges and competences obtained by the students will be made in a continous way along the term and will consist of the following assessment blocks:

1. Theory and practice: The assessment will be done in two stages:

-Continuous assessment of participation in practical and theoretical lectures and the presentation of results in practical sessions. Moreover, if the teachers consider it suitable, the can prepare tests along the term. This assessment will have a weight of 10 % (one point) of the final mark.

-Final assessment consisting in theoretical-practical exams, whose weight in the final mark is the 80 % (eight points) of the final score.

In order to pass the exams it will be necessary to obtain a minimum mark of 4 points over 10 in the exam.



2. Seminars:

The participation and attendance in the sessions of the seminari will be assessed, whose weight on the final score in one point, that is, 10 % of the final score.

SECOND CALL: The mark obtained in the continuous assessment and the seminar sessions will be used for the second call. The continuous assessment and the seminars will not be recoverable.

REFERENCES

Basic

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Referència b1: T. W. Hungerford; Algebra, Springer; 1974

Referència b2: B. Jacob, Algebra; Freeman and Co.; 1990

Referència b3: N. Jacobson; Lectures in Abstract Algebra II; Freeman and Co., 1985

Referència b4: J. Sancho San Román; Álgebra lineal y geometría; Octavio y Felex, 1985

Referència b5: K. Spindler; Abstract algebra with applications, vol. I; Marcel Dekker, 1994

Referència b6: R. López Machí, J. Martínez Verduch; Polinomios, matrices y cuádricas; Publicacions Universitat de València, 2016

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

In the event of a closure of the facilities due to the health situation, and if this affects all or part of the classes of the subject, these will be replaced by classes where physical attendance will be replaced by online synchronous classes following the established schedules, and with asynchrony work from home.

In the event of a closure of the facilities due to the health situation, and if this affects any of the face-to-face tests of the subject, these will be replaced by tests of a similar nature but in virtual mode through the supported computer tools by the University of Valencia. The evaluation percentages will remain the same as those established in the guide.