VNIVERSITAT DE VALÈNCIA

Course Guide
34237 Algebra and geometry II

COURSE DATA

Data Subject	
Code	34237
Name	Algebra and geometry II
Cycle	Grade
ECTS Credits	6.0
Academic year	2020 - 2021

Study (s)

Degree	Center	Acad. year	Period
1105 - Degree in Physics	Faculty of Physics	1	Second term
1929 - D.D. in Physics-Chemistry	Double Degree Program Physics and Chemistry	1	Second term

Subject-matter

Degree	Subject-matter	Character
1105 - Degree in Physics	2 - Mathematics	Basic Training
1929 - D.D. in Physics-Chemistry	1 - Primer Curso (Obligatorio)	Obligatory

Coordination

Name	Department
PERUCHO PLA, MANEL	16 - Astronomy and Astrophysics

SUMMARY

Objectives:
To acquire basic knowledge of mathematics in the area of algebra and geometry, essential for studies in Physics.

Descriptor of the subject in the curriculum (Algebra and Geometry I and II):

Complex numbers. Algebraic structures. Vector spaces. Matrices and determinants. Systems of linear equations. Linear operators. Diagonalization. Euclidean geometry. Tensors.

Relationship with other materials prior, concurrent and future: instrumental course, a primary to study physics in any of their specialities. Complementary to other subjects of Mathematics and Mathematical Methods.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

Secondary school Mathematics:
Vector spaces. Matrices. Determinants. Linear equation systems. Vectors. Geometry. Metric problems. Successions and numerical series. Function limits. Continuity. Derivatives. Taylor developments. Integration.

OUTCOMES

1105 - Degree in Physics

- To know how to apply the knowledge acquired to professional activity, to know how to solve problems and develop and defend arguments, relying on this knowledge.
- Capacity to communicate information, ideas, problems and solutions to a specialist and a general audience.
- Developing learning skills so as to undertake further studies with a high degree of autonomy.
- Be able to understand and master the use of the most commonly used mathematical and numerical methods.
- Modelling & Problem solving skills: be able to identify the essentials of a process / situation and to set up a working model of the same; be able to perform the required approximations so as to reduce a problem to an approachable one. Critical thinking to construct physical models.
- Destrezas Generales y Específicas de Lenguas extranjeras: Mejorar el dominio del inglés científico-técnico mediante la lectura y acceso a la bibliografía fundamental de la materia.
- Comunicación oral y escrita: Ser capaz de transmitir información, ideas, problemas y soluciones mediante la argumentación y el razonamiento propios de la actividad científica.

LEARNING OUTCOMES

-Linear equation systems.
-Eigenvalues and eigenvectors of linear operators.
-Introduction to euclidean vector spaces. Vector spaces with scalar product.
-Changes of coordinate systems in the affine space. Basic ideas on rotation and reflection.
-Dual spaces. Multilinear applications. Tensor algebra.

-Linear equation systems.

DESCRIPTION OF CONTENTS

1. Matrices, determinants and linear equations

Matrix NxM (definition and operations; transposed and adjoint). Determinant of a matrix (definition and calculation, properties). Inverse of a matrix (definition and calculation. Range of a matrix). Resolution of linear equations (Cramers rule).

2. Linear operators

Linear operators. Matrix of a linear operator. Adjoint operator (matrix representation). Normal operators (self-adjoint and unitary operators, change of base). Projector representation.

3. Spectral theory

Eigenvalues and eigenvectors. Eigenvalues and eigenvectors of normal operators (self-adjoint and unitary operators). Diagonalization of an operator (Change of base. Function of an operator). Spectral decomposition of a normal operator.

4. Tensors. Algebraic theory

Dual space. Multilinear applications. Covariant and contravariant tensors. Change of base formula. Symmetric and antisymmetric tensors.

5. Affine space

Affine space (introduction, Cartesian coordinates). Change of reference in the affine space. Orthogonal transformations in the affine space (rotations and reflections in two and three dimensions). Curvilinear coordinate systems (polar coordinates, cylindrical and spherical coordinates).

6. Spatial analytic geometry

Position problems and metric problems in the three-dimensional space (definition of lines and planes, use of vectors to find distances and angles). Introduction to quadratic forms.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	45,00	100
Tutorials	15,00	100
Development of individual work	15,00	0
Study and independent work	65,00	0
Preparation of evaluation activities	10,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

Contact teaching (40%)

Theoretical and practical classes: It addresses the conceptual and formal matter and resolution of problems or cases as the application of theoretical concepts. They are based on lectures and mainly the use of dialogic teaching tools as graphical representation of solutions,
design presentations, etc.).

Group tutoring sessions in small working groups, focused on active student participation: dealing with doubts in theoretical concepts and problem solving, reinforcement in areas of greatest difficulty, conceptual questionnaires, experimental demonstrations relevant to studied cases, and associated with an ongoing evaluation and monitoring the student's progress in the field.

Student's Personal work (60%):

- Study of the theoretical concepts.

- Resolution of exercises and problems, individually and in groups.

-Individual tutorials: questions addressed to the teacher on difficulties encountered in the study and resolution of problems or discussion on topics of interest, bibliography, etc.

EVALUATION

The assessment system is as follows:

1) Written examinations: One part will assess the understanding of the theoretical-conceptual and formal nature of the subject, both through theoretical questions, conceptual questions and numerical or simple particular cases. Another part will assess the applicability of the formalism, by solving problems and critical capacity regarding the results. Proper argumentations and adequate justifications will be important in both cases. The minimum mark to be got in each of the parts to pass the course is 3/10.

2) Continuous assessment: assessment of exercises and problems presented by students, questions proposed and discussed in class, oral presentation of problems solved or any other method that involves an interaction with students.

3) The final mark will be the maximum of the examination mark and the examination mark weighted with the mark of the continuous assesment, with a 30% weight for the continuous assesment (and 70% for the exam).

COMMENTS: Subject to compliance with the compensation criteria established for this purpose, note this course can be averaged with other others belonging to the same matter, so as to pass the course.

REFERENCES

Basic

- K. F. Riley, M. P. Hobson, S. J. Bence, Mathematical Methods for Physicist and Engineering. Cambridge University Press (1998).
- D. J. E. Puertas, P. M. Marqués, Matemática Universitaria. Álgebra. Bello (1973).
- Riley,K.F., Hobson, M. P, Student solutions manual for mathematical methods for physics and engineering. Cambridge University Press (2003).

Additional

- F. Granero, Álgebra y geometría Analítica. McGraw Hill (1985).
- J. De Burgos, Curso de Álgebra y Geometría. Alhambra S.A. (1976).
- G. Strang, Introduction to linear algebra. Wellesley-Cambridge Press (1993).
- A. G. Kurosch, Curso de álgebra superior. Mir (1977).

ADDENDUM COVID-19

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

English version is not available

METODOLOGÍA DOCENTE:

Durante el mes de febrero 2021, la docencia de teorías y seminarios-trabajos tutelados, pasan a modalidad de videoconferencia síncrona impartida en el horario fijado por la asignatura y el grupo.

A partir del 1 de marzo, se seguirá la modalidad docente indicada en la Guía Docente y a las modalidades docentes aprobadas en las Comisiones Académicas de Título de los meses de julio 2020 y noviembre 2020, respectivamente, salvo que las autoridades sanitarias y Rectorado indican una nueva reducción de presencialidad, en cuyo caso se volvería a la modalidad de videoconferencia síncrona.