COURSE GUIDE

Mathematical Methods 3 (2671126)

Approval date:
Departamento de Física Teórica y del Cosmos: 22/06/2023
Departamento de Física Atómica, Molecular y Nuclear: 23/06/2023

Grado (Bachelor's Degree)	Grado en Física	**Branch**	Sciences
Module	Métodos Matemáticos y Programación	**Subject**	Métodos Matemáticos

Year of study	2º	**Semester**	2º	**ECTS Credits**	6	**Course type**	Compulsory course

PREREQUISITES AND RECOMMENDATIONS

Linear Algebra and Geometry I and II, Calculus I, and Mathematical Methods I

BRIEF DESCRIPTION OF COURSE CONTENT (According to the programme's verification report)

- Hilbert spaces
- Series expansions, eigenfunctions

SKILLS

GENERAL SKILLS

- CG01 - Skills for analysis and synthesis
- CG02 - Organisational and planification skills
- CG03 - Oral and written communication
- CG05 - Skills for dealing with information
- CG06 - Problem solving skills
- CG07 - Team work
- CG08 - Critical thinking
- CG09 - Autonomous learning skills
- CG10 - Creativity
- CG11 - Initiative and entrepreneurship

SUBJECT-SPECIFIC SKILLS

- CE03 - Knowing and understanding the mathematical methods necessary to describe physical phenomena
- CE05 - Modelling complex phenomena, translating a physical problem into mathematical language

LEARNING OUTCOMES

That the student understands the general concepts of Hilbert spaces, especially in their application to Physics, and is able to solve the associated problems.

PLANNED LEARNING ACTIVITIES

THEORY SYLLABUS

Unit 1. Normed spaces and Banach spaces.
Unit 2. Euclidean spaces and Hilbert spaces.
Unit 3. Function spaces and series expansions.
Unit 4. Functionals and distributions.
Unit 5. Linear operators.
Unit 6. Introduction to spectral theory.

PRACTICAL SYLLABUS

RECOMMENDED READING

ESSENTIAL READING

1. L. Abellanas y A. Galindo, Espacios de Hilbert, Eudema, 1987.
2. S. K. Berberian, Introducción al espacio de Hilbert, Teide, 1977.
3. P. García González, J. E. Alvarellos Bermejo y J. J. García Sanz, Introducción al formalismo de la mecánica cuántica, U.N.E.D., Madrid, 2001.
4. G. Helmberg, Introduction to spectral theory in Hilbert space, North Holland, 1969.
5. R. P. Kanwall, Generalized functions (theory and technique), Academic Press, 1983.
6. A. N. Kolmogórov y S.V. Fomín, Elementos de la teoría de funciones y del análisis funcional, M.I.R., 1975.
7. R.D. Richtmyer, Principles of Advanced Mathematical Physics, vol. 1, Springer-Verlag, 1978.
8. P. Roman, Some modern mathematics for physicists and other outsiders, vol. 2, Pergamon, 1975.
9. A. Vera López y P. Alegría Ezquerra, Un curso de Análisis Funcional. Teoría y problemas, AVL, 1997.
10. E. Romera Gutiérrez, M. C. Boscá Díaz-Pintado, F. Arias de Saavedra Alías, F. J. Gálvez Cifuentes, J. I. Porras Sánchez, Métodos Matemáticos: Problemas de Espacios de Hilbert, Operadores lineales y Espectros, Paraninfo, 2013.

COMPLEMENTARY READING

TEACHING METHODS

- MD01 - Theoretical classes

ASSESSMENT METHODS (Instruments, criteria and percentages)

ORDINARY EXAMINATION DIET

The evaluation will be carried out mainly from the exams. Additional consideration will be given to the individual solution of problems and/or tasks, from which the students will demonstrate the acquired knowledge and understanding.

- In the ordinary call, the final exam grade will constitute 70% of the grade (A), and the remaining 30% (B) will be evaluated in a complementary way according to one or more of the following criteria: participation in class, submission of problems and/or tasks, oral or written assessments,...
- To pass the course it will be necessary to obtain at least 4 points (out of 10) in the final exam grade.

EXTRAORDINARY EXAMINATION DIET

- Final exam with theoretical questions and problems, related to the subject taught in class.
- As a general rule, the exam will correspond to 100% of the grade. However, upon student request, the exam will count towards 70% of the grade, with the remaining 30% corresponding to the grade obtained in part B of the ordinary call. In this case, it will be necessary to obtain at least 4 points (out of 10) in the final exam grade.

SINGLE FINAL ASSESSMENT (evaluación única final)

- Those students who, following the Regulations of the UGR with terms and deadlines that are required therein, take advantage of this evaluation modality, will carry out the final evaluation only.
- It will consist of an exam involving theoretical questions and/or problems.