Real and functional analysis

2018/2019

Code: 100110
ECTS Credits: 6

Degree	Type	Year	Semester
2500149 Mathematics	OT	4	0

Contact

Name: Joan Orobitg Huguet

Email: Joan.Orobitg@uab.cat

Use of languages

Principal working language: catalan (cat)

Some groups entirely in English: No

Some groups entirely in Catalan: Yes

Some groups entirely in Spanish: No

Prerequisites

All the previous courses of Calculus and Mathematical Analysis.

Good knowledge of Linear Algebra and Basic Topology is also important.

Objectives and Contextualisation

Explain the concepts and fundamental results of the Lebesgue integral in Euclidean space.

Present the methods of functional analysis, in the context of Banach spaces and Hilbert spaces.

Content

The course consists of 3 blocks:

Theory of Measure, Banach Spaces and Hilbert Spaces.

1. Limitations of the Riemann integral.

2. Lebesgue measure. Abstract measure theory.

3. Lebesgue integral. Abstract integral theory. Limit vs. integral.

4. Fundamental Theorem of Calculus. Variable change theorem. Fubini-Tonelli theorem.

5. Integrals dependent on a parameter. Differentiating under the integral sign.

6. Normed spaces. Banach spaces. Characteristics.

7. Spaces of sequences. Spaces of functions. Spaces of measures.

8. Bounded linear operators. Norm of an operator. Topology of bounded linear operators.

9. Applications: Volterra's integral equation.

10. Open Mapping Theorem and Closed Graph Theorem. Uniform boundedness principle.

11. Dual topological of a normed space. Hahn-Banach theorem.

12. Hilbert spaces. Theorem of the Projection. Orthogonality

13. Hilbertian basis. Bessel inequality. Parseval's identity.

14. Fourier series. Riemann-Lebesgue lemma.

15. Compact operators. Sturm-Liouville problem.