Universitat Autònoma de Barcelona

2020/2021

Harmonic analysis

Code: 100111
ECTS Credits: 6

Degree	Type	Year	Semester
2500149 Mathematics	OT	4	0

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

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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

The first and second year Analysis courses of the mathematics degree. It is also useful, but not essential, to have

Objectives and Contextualisation

The main objective is to describe the way in which Harmonic Analysis allows to decompose a function as a sum o

Competences

- Actively demonstrate high concern for quality when defending or presenting the conclusions of ones work.
- Assimilate the definition of new mathematical objects, relate them with other contents and deduce their properties.
- Develop critical thinking and reasoning and know how to communicate it effectively, both in ones own languages and in a third language.
- Effectively use bibliographies and electronic resources to obtain information.
- Formulate hypotheses and devise strategies to confirm or reject them.
- Generate innovative and competitive proposals for research and professional activities.
- Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
- Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
- Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
- Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.

Learning Outcomes

1. Actively demonstrate high concern for quality when defending or presenting the conclusions of ones work.
2. Develop critical thinking and reasoning and know how to communicate it effectively, both in ones own languages and in a third language.
3. Effectively use bibliographies and electronic resources to obtain information.
4. Formulate conjectures and devise strategies to confirm or reject said conjectures
5. Generate innovative and competitive proposals for research and professional activities.
6. Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
7. Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
8. Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
9. Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
10. Understand and know how to reproduce basic results in relation to the Hilbert transform.

Content

1. Fourier series and applications
2. Fourier integrals and applications.
3. The Poisson summation formula. The Heisenberg Uncertainty Principl
4. Fourier analysis in finite abelian groups. Dirichlet's theorem on prime r

Methodology

The standard one in Mathematics. Discussion of definitions, examples and Theorems. We will also have problem sessions.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Directed	30	1.2	5, 8, 6
Type: Supervised			
Supervised	20	0.8	10, 5, 8, 6
Type: Autonomous			
Autonomous	85	3.4	10, 5, 8, 6

Assessment

The subject will be evaluated according to the three activities and their weights shown in the table.
Students who do not pass the course can repeat the final exam with the s

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Exercises	40%	1	0.04	1, 2, 10, 4, 5, 9, 8, 6, 7, 3
Final Exam	50%	4	0.16	1, 2, 10, 4, 5, 9, 8, 6, 7, 3
Oral Exam	10%	10	0.4	1, 2, 10, 4, 5, 9, 8, 6, 7, 3

Bibliography

1. E. Stein and R. Shakarchi, "Fourier Analysis, an introduction", Princeton Lectures in Analysis, Priceton Univresity Press 2007

2. Gasquet-Witomski, "Fourier Analysis and applications". Springer-Verlag, 1999.

3. S. Mallat, "A wavelet tour of signal processing", Academic Press, 1999

4. J.Bruna, Anàlisi Real, Materials UAB, 26.