UCLouvain

lmat2415

2024

Advanced harmonic analysis

5.00 credits	30.0 h + 15.0 h	Q1

Teacher(s)	Van Schaftingen Jean ;
Language :	French
Place of the course	Louvain-la-Neuve
Prerequisites	It is recommended that the student master the basic notions of Lebesgue integrals as covered in LMAT1221 and functional spaces as covered in LMAT1321.
Main themes	Mathematical analysis of Fourier series and transforms, singular integrals and associated function spaces.
Learning outcomes	**At the end of this learning unit, the student is able to :** Contribution of the course to the learning outcomes of the Master's programme in mathematics. At the end of this activity, the student will have progressed in : - The ability to acquire independently and exploit new knowledge and skills throughout their professional life - The capacity for abstraction, reasoning and critical thinking. He/she will be able to : 1. Identify the unifying aspects of different situations and experiences. 2. Reason within the framework of the axiomatic method 3. Construct and write a proof in an autonomous, clear and rigorous way. - The ability to communicate scientifically. He/she will be able to : 1. Write a mathematical text according to the conventions of the discipline. 2. Structure an oral presentation by adapting it to the level of expertise of the interlocutors. - The ability to identify the unifying aspects of different situations and experiments in mathematics or related fields, using the abstract and experimental approach of the exact sciences. - The capacity for abstraction and critical thinking, with the aim of becoming able to : 1. reasoning within the framework of the axiomatic method 2. Recognise the key arguments and structure of a demonstration. 3. Construct and write a demonstration independently. 1 4. Appreciate the rigour of a mathematical or logical argument and detect possible flaws. 5. Distinguish between the intuition of the validity of a result and the different levels of rigorous understanding of the same result. - Clarity, precision and rigour in communication activities with the aim of becoming able to Write a mathematical text according to the conventions of the discipline. - The ability to learn independently. He/she will be able to : 1. search for sources in the mathematical literature and judge their relevance. 2. correctly situate an advanced mathematical text in relation to acquired knowledge. Course-specific learning outcomes. At the end of this activity, the student will be able to : - Present contexts, especially in functional analysis, partial differential equations and signal processing, involving harmonic analysis concepts, methods and results, and interpret them in their context. - Present the various concepts, methods and results of harmonic analysis using definitions, examples and demonstrations. - Apply and present techniques of real analysis, functional analysis and measurement theory to the study of harmonic analysis. The contribution of this unit to the development and mastery of the competences and achievements of the programme(s) can be found at the end of this sheet in the section " The contribution of this unit to the development and mastery of the skills and knowledge of the programme(s) can be found at the end of this sheet in the section "Programmes/training courses offering this unit".

Evaluation methods	The final assessment will be based on : • preparation, presentation and participation in the discussion sessions during the term (25% of the mark), • solutions of exercises (25% of the mark), • a written final examination (50% of the grade). The personal production part will be attached to all sessions of the current academic year.
Teaching methods	• presentations by the teacher, • presentation by the students and discussion, • student solving of exercises and presentation in various written and/or oral formats.
Content	• Fourier series and integrals • Hardy-Littlewood maximum function • Hilbert transform • singular integrals
Inline resources	Documents complémentaires disponibles sur Moodle.
Bibliography	Stein, *Singular integrals and differentiability properties of fonctions,* Princeton University Press, 1970. Stein and Weiss, *Introduction to Fourier analysis on Euclidean spaces,* Princeton University Press, 1971.
Faculty or entity in charge	MATH

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Mathematics	MATH2M	5		🔍
Master [60] in Mathematics	MATH2M1	5		🔍