UCLouvain

lmat1221

2021

Mathematical analysis : integration

5.00 credits	30.0 h + 30.0 h	Q1

Teacher(s)	Olbermann Heiner ;
Language :	French
Place of the course	Louvain-la-Neuve
Prerequisites	*The prerequisite(s) for this Teaching Unit (Unité d'enseignement – UE) for the programmes/courses that offer this Teaching Unit are specified at the end of this sheet.*
Main themes	The course will cover the study of integral calculus in several variables, limit crossing in integrals and integration by parts.
Learning outcomes	**At the end of this learning unit, the student is able to :** Contribution of the course to the learning outcomes of the bachelor's degree program in mathematics At the end of this activity, the student will have progressed in : Knowledge and understanding of a fundamental foundation of mathematics with the goal of becoming able to: - Select and use fundamental computational methods and tools to solve mathematical problems. - Recognize the fundamental concepts of important current mathematical theories. - Establish the main connections between these theories, explain them and motivate them with examples. The ability to identify, through the abstract and experimental approach characteristic of the exact sciences, the unifying aspects of different situations and experiences in mathematics or related fields. The capacity for abstraction and critical thinking, with the aim of becoming capable of : - Reason within the framework of the axiomatic method. - Recognize the key arguments and structure of a demonstration. - Construct and write a demonstration independently. - Appreciate the rigor of a mathematical or logical reasoning and detect possible flaws. - 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. 1 Specific learning outcomes of the course. At the end of this activity, the student will be able to : - define and illustrate with examples the fundamental mathematical concepts of differential and integral calculus, such as integral, measure, and negligible sets, - state the fundamental theorems of multivariate integral calculus, including the basic properties of the integral and measure of sets, exchange of order of integration, change of variable, boundary crossing under the integral sign and integration by parts - compare theorems and definitions by identifying the situations in which they apply and the results they provide, - illustrate the application of the fundamental theorems of multivariate integral calculus with relevant examples - illustrate definitions, theorems and examples graphically, - motivate statements of fundamental theorems in multivariate integral calculus with counterexamples that illustrate the necessity of the assumptions, - prove theorems in multivariate integral calculus from the definitions or from other propositions, - apply the definitions and theorems of multivariate integral calculus to the calculation and asymptotic study of integrals and measures, possibly involving a parameter, including Fourier analysis, the study of special functions and probability theory - interpret the results of a calculation or an asymptotic study in geometric, probabilistic or physical contexts.

Evaluation methods	Skill acquisition will be assessed in homework assignments and on a final exam. Questions will require : - render material, including definitions, theorems, proofs, examples, - select and apply methods from the course to solve problems and exercises - adapt methods of demonstration from the course to new situations, - synthesize and compare objects and concepts. The evaluation will focus on : - knowledge, understanding and application of the various mathematical objects and methods of the course - the accuracy of the calculations, - the rigor of the developments, proofs and justifications, - the quality of the writing of the answers.
Teaching methods	The learning activities consist of lectures and practical sessions. The lectures aim to introduce the fundamental concepts, to motivate them by showing examples and establishing results, to show their reciprocal links and their links with other courses in the Bachelor of Mathematical Sciences program. The practical sessions aim at learning to choose and use methods of calculation and to construct demonstrations. Both activities take place in class.
Content	Notions of completeness and integral calculus in several variables : - integral in space - theorems of convergence of integrals - Fubini's theorems and change of variables - surface integral and divergence theorem
Inline resources	Notes from the course will be available online on Moodle.
Bibliography	
Faculty or entity in charge	MATH

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Minor in Mathematics	MINMATH	5		🔍
Bachelor in Mathematics	MATH1BA	5	LMAT1122	🔍
Additionnal module in Physics	APPHYS	5		🔍