UCLouvain

lmat2140

2024

Algebraic topology

5.00 credits	30.0 h + 15.0 h	Q1

This biannual learning is being organized in 2024-2025

Teacher(s)	Lambrechts Pascal ;
Language :	English
Place of the course	Louvain-la-Neuve
Prerequisites	LMAT1131 - linear algebra (first year Bachelor of Mathematical Sciences) or equivalent course. LMAT1231 - multilinear algebra and group theory (second year Bachelor of Mathematical Sciences) or equivalent course. LMAT1323 - topology (Second Year B.Sc. Mathematics) or equivalent course.
Main themes	Classification of surfaces. Euler's characteristic. Fundamental group. Coating. Homology.
Learning outcomes	**At the end of this learning unit, the student is able to :** 1 **Contribution of the course to the learning outcomes of the master's program in mathematics.** **At the end of this activity, the student will have progressed in his/her ability to :** - Acquire independently and exploit new knowledge - Demonstrate abstraction, reasoning and critical thinking skills. In particular, they will have developed their ability to -- read a demonstration and recognize its steps, key arguments and structure -- appreciate the simplicity, the clarity, the rigor, the originality of a demonstration and of a mathematical or logical reasoning and detect possible flaws. - Fundamental disciplinary knowledge and skills, including : -- His or her knowledge of the fundamental concepts of important current mathematical theories and will be able to establish the key connections between these theories. -- His/her expertise in fundamental computational tools and their use in mathematical problems. - Scientific communication, especially structuring an oral presentation, highlighting key elements, distinguishing techniques and concepts, and adapting the presentation to the level of expertise of the audience. **Course-specific learning outcomes.** **At the end of this activity, the student will be able to :** - Recognize, classify and construct surfaces. - Compute on simple examples classical invariants of algebraic topology : fundamental group, Euler class, homology group. - Deduce some topological properties of spaces from invariants of algebraic topology. - Develop in detail an element of algebraic topology theory.
Evaluation methods	Evaluation will consist of a written and oral examination after the quadrennium. Assignments may be offered during the year, the grades of which may offer bonuses to the final grade.
Teaching methods	Combination of lectures, directed readings, and exercises
Content	This activity is a first course in algebraic topology. It is highly recommended to take lmat2215 "homological algebra" in parallel or to have already taken a course in homological algebra. **The following contents are covered in this course :** - Basic notions: homotopy, construction of topological spaces, reminder of varieties, reminder of the classification of surfaces. - Degree of a continuous application of the circle in itself and applications. - Fundamental group: definition and methods of calculation including the Seifet-Van Kampen theorem. Presentation of a group by generators and relations

	- Cladding: definitions, examples, links with the fundamental group; universal cladding; raising theorems; classification theorems. - Homology of spaces: definition of simplicial homology and examples of calculations; applications. If time permits, more advanced applications of homology of spaces.
Inline resources	Course web page on moodle
Bibliography	La bibliographie sera précisée sur la page moodle du cours ---- The bibliography will be specified on the moodle page of the course
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		🔍