University of Gdańsk

Subject card

Subject name and code	Algebraic Topology, PG_00210290		
Field of study	Mathematics		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2026/2027
Education level	Master's studies	Subject group	Obligatory subject group in the field of study Optional subject group
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	English
Semester of study	4	ECTS credits	6.0
Learning profile	academic	Assessment form	credit
Conducting unit	Division of Geometry -> Institute of Mathematics -> Faculty of Mathematics, Physics and Informatics -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Maciej Mroczkowski	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	30.0	0.0	0.0	0.0	60

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	60	10.0	80.0	150

Subject objectives	Learning advanced mathematical constructions in the field of algebraic topology, acquiring the ability to apply algebraic methods in topology.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MATMU2_U05] can perform proofs in a selected field and, if necessary, also use tools from other areas of mathematics	The student is able to carry out proofs in the field of algebraic topology using the methods of algebra and topology.	[SU4] test/exam - oral or written [SU8] observation of student's independent or team work
[MATMU2_W03] knows and understands in-depth a selected field of theoretical or applied mathematics and is able to understand the formulations of issues in this field that are still at the research stage and knows the connections of issues in this field with other areas of mathematics	The student knows and understands algebraic topology in depth and is able to understand its connections with other branches of mathematics, in particular algebra or topology.	[SW4] test/exam - oral or written
[MATMU2_U07] is able to define his/her interests and develop them; in particular, is able to establish contact with specialists in his/her field, e.g. understand their lectures intended for young mathematicians	The student is able to identify his or her interests and develop them; in particular, he or she is able to establish contacts with specialists in topology or algebra.	[SU1] oral statement/conversation/ discussion [SU8] observation of student's independent or team work
[MATMU2_K02] is ready to precisely formulate questions to deepen his/her understanding of a given topic or find missing elements of reasoning	The student is ready to formulate precise questions that serve to deepen his or her understanding of a given topic or to find missing elements of reasoning.	[SK8] observation of student's independent or team work
[MATMU2_W02] knows and understands well the role and importance of the construction of mathematical reasoning	The student knows and understands well the role and importance of constructions of mathematical reasoning in the field of algebraic topology.	[SW1] oral statement/ conversation/discussion
[MATMU2_U03] can understand mathematical texts of various types from selected fields of mathematics	The student is able to understand mathematical texts of various types, in the field of algebraic topology.	[SU8] observation of student's independent or team work
[MATMU2_W01] knows and understands in-depth the theory of selected areas of mathematics	The student possesses a thorough understanding of the theory of algebraic topology. Specifically, they can formulate theorems and be familiar with definitions, formulas, examples, and counterexamples.	[SW4] test/exam - oral or written
[MATMU2_K04] is ready to understand and appreciate the importance of intellectual honesty in one's own and other people's actions; ethical conduct	The student is ready to understand and appreciate the importance of intellectual honesty in his own and other people's actions; ethical conduct	[SK8] observation of student's independent or team work
[MATMU2_K01] is willing to acknowledge the limitations of his or her own knowledge and is willing to pursue further education	The student is ready to acknowledge the limitations of one's own knowledge and pursue further education.	[SK8] observation of student's independent or team work
[MATMU2_U01] can construct mathematical reasoning: prove theorems and refute hypotheses through construction and selection of counterexamples	In the field of algebraic topology the student is able to construct mathematical arguments: prove theorems and refute hypotheses through construction and selection of counterexamples.	[SU8] observation of student's independent or team work
[MATMU2_K05] is ready to independently search for information in literature, also in foreign languages	The student is ready to independently search for information in the literature in the fields of topology and algebra.	[SK8] observation of student's independent or team work
[MATMU2_U04] is able, at an advanced level and including modern mathematics, to apply and present, orally and in writing, methods of at least one selected branch of mathematics	The student is able to present mathematical arguments in algebraic topology at an advanced level, both orally and in writing.	[SU4] test/exam - oral or written
[MATMU2_K06] is ready to formulate opinions on basic mathematical issues	The student is ready to formulate opinions on basic mathematical issues in the field of algebraic topology.	[SK8] observation of student's independent or team work
[MATMU2_U06] is able to apply methods and examples from a selected field of mathematics in related fields	The student is able to solve problems in algebraic topology using standard methods of algebraic and topological analysis.	[SU4] test/exam - oral or written [SU8] observation of student's independent or team work

<table>
<tr><td>Subject contents</td><td>1. Higher homotopy groups.
2. CW-complexes.
3. Homology functors, singular homologies.
4. Homotopy invariance theorems.
5. The relationship between the fundamental group and the first singular homology group.
6. Relative homologies, exact homology sequences.
7. The section theorem, applications to spheres.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td></td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>observation of the student's attitude</td><td>51.0%</td><td>0.0%</td></tr>
<tr><td>tests</td><td>51.0%</td><td>50.0%</td></tr>
<tr><td>exam</td><td>51.0%</td><td>50.0%</td></tr>
</table>
</td></tr>
<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>1. M. J. Greenberg, Wykłady z topologii algebraicznej, PWN Warszawa 1980
2. R. Duda, Wprowadzenie do topologii II, PWN Warszawa 1986
3. E. H. Spanier, Topologia algebraiczna, PWN Warszawa 1972
4. A. Hatcher, Algebraic topology, Cambridge Univ.Press http://www.math.cornell.edu/?hatcher</td></tr>
<tr><td>Supplementary literature</td><td>not included</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>not included</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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