SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	**Babes-Bolyai University**
1.2 Faculty	**Mathematics and Computer Science**
1.3 Department	**Department of Mathematics**
1.4 Field of study	**Mathematics**
1.5 Study cycle	**Master of Science**
1.6 Study programme / Qualification	**Master of Advanced Mathematics**

2. Information regarding the discipline

2.1 Name of the discipline	**Algebraic topology**						
2.2 Course coordinator	**Prof.PhD. Dorin Andrica**						
2.3 Seminar coordinator	**Prof.PhD. Dorin Andrica**						
2.4. Year of study	**2**	2.5 Semester	**1**	2.6. Type of evaluation	**E**	2.7 Type of discipline	Compulsory

3. Total estimated time (hours/semester of didactic activities)

3.1 Hours per week	3	Of which: 3.2 course	2	3.3 seminar/~~laboratory~~	1
3.4 Total hours in the curriculum	42	Of which: 3.5 course	28	3.6 seminar/~~laboratory~~	14
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					40
Additional documentation (in libraries, on electronic platforms, field documentation)					44
Preparation for seminars/labs, homework, papers, portfolios and essays					50
Tutorship					10
Evaluations					14
Other activities:					-

3.7 Total individual study hours	158
3.8 Total hours per semester	200
3.9 Number of ECTS credits	8

4. Prerequisites (if necessary)

4.1. curriculum	• General topology • Mathematical analysis • Basic algebra
4.2. competencies	• Comparative assessment and efficient use of various methods of proof

5. Conditions (if necessary)

5.1. for the course	•

5.2. for the seminar /~~lab activities~~	•

6. Specific competencies acquired

Professional competencies	• Description of concepts, theories and models used in the application field • Identification of adequate models and methods for solving real problems
Transversal competencies	• Efficient fulfillment of organized activities in an inter-disciplinary group and development of empathic abilities of inter-personal communication, relationship and collaboration with various groups

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	• To introduce the basic notions and results of Algebraic Topology as well as some of its applications
7.2 Specific objective of the discipline	• To present some applications of Algebraic Topology to various fields of Mathematics

8. Content

8.1 Course	Teaching methods	Remarks
1. Connected and locally connected spaces	interactive exposure, explanation, didactical demonstration	
2. Path connected spaces	interactive exposure, explanation, didactical demonstration	
3. The first steps in the algebraic study of connected spaces	interactive exposure, explanation, didactical demonstration	
4. Homotopic maps and homotopic spaces	interactive exposure, explanation, didactical demonstration	
5. The fundamental group	interactive exposure, explanation, didactical demonstration	
6. The fundamental group of the circle S^1	interactive exposure, explanation, didactical demonstration	
7. The computation of the fundamental group	interactive exposure, explanation, didactical demonstration	
8. Seifert-VanKampen theorem	interactive exposure, explanation, didactical demonstration	
9. Covering spaces	interactive exposure, explanation, didactical demonstration	
10. Covering spaces and fundamental group	interactive exposure, explanation, didactical demonstration	
11. Covering transformations	interactive exposure, explanation,	

	didactical demonstration	
12. Topological groups. Lie groups	interactive exposure, explanation, didactical demonstration	
13. Classical Lie groups of matrices	interactive exposure, explanation, didactical demonstration	
14. The topology of classical Lie groups of matrices	interactive exposure, explanation, didactical demonstration	

Bibliography

1. D.Andrica, C.Pintea, *Elemente de teoria omotopiei cu aplicatii la studiul punctelor critice*, Editura MIRTON, Timisoara, 2002.
2. D.Andrica, I.N.Casu, *Grupuri Lie, aplicatia exponentiala si mecanica geometrica*, Presa Universitara Clujeana, 2008.
3. A.Dold, *Lectures on Algebraic Topology*, Springer-Verlag, Berlin-Heidelberg-New York, 1972.
4. M.J.Greenberg, J.R.Harper, Algebraic Topology.A first course, Addison-Wesley, 1981.
5. C.Godbillon, *Elements de topologie algebrique*, Hermann, Paris, 1971.
6. S-T. Hu, *Homotopy Theory*, Academic Press, New York and London, 1959.
7. W.S.Massey, *Algebraic Topology: An Introduction*, Harcourt, Brace&World, 1967.
8. I.Pop, *Topologie algebrica*, Editura Stiintifica, Bucuresti, 1990.
9. E.Spanier, *Algebraic Topology*, McGraw Hill, 1966.

8.2 Seminar ~~/ laboratory~~	Teaching methods	Remarks
1. Topological spaces. Subspaces. Examples	interactive exposure, conversation	
2. Compactness. Products	interactive exposure, conversation	
3. Complete metric spaces	interactive exposure, conversation	
4. Locally compact spaces	interactive exposure, conversation	
5. Paracompact spaces	interactive exposure, conversation	
6. Quotient spaces	interactive exposure, conversation	
7. Direct sums of Abelian groups	interactive exposure, conversation	
8. Exact sequences of Abelian groups	interactive exposure, conversation	
9. Free Abelian groups	interactive exposure, conversation	
10. Free products and amalgamated products	interactive exposure, conversation	
11. Galois coverings	interactive exposure, conversation	
12. Examples of topological groups	interactive exposure, conversation	
13. Quotient spaces obtained by the action of a topological group. Examples	interactive exposure, conversation	
14. More on the classical Lie groups of matrices	interactive exposure, conversation	

Bibliography

1. D.Andrica, C.Pintea, *Elemente de teoria omotopiei cu aplicatii la studiul punctelor critice*, Editura MIRTON, Timisoara, 2002.
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3. M.J.Greenberg, J.R.Harper, Algebraic Topology.A first course, Addison-Wesley, 1981.
4. C.Godbillon, *Elements de topologie algebrique*, Hermann, Paris, 1971.

5. W.S.Massey, *Algebraic Topology: An Introduction*, Harcourt, Brace&World, 1967.

6. I.Pop, *Topologie algebrica*, Editura Stiintifica, Bucuresti, 1990.

9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

- The contents is directed towards applications of Algebraic Topology to mathematical research.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	To understand the notions and the results by typical examples or counterexamples. To be able to present the main ideas in the proof of the theoretical results.	Written exam	60%
	To develop a specific subject by reading the bibliography.	Report	20%
10.5 Seminar/~~lab activities~~	Solving problems skills	Quiz Continous observations	10% 10%
	Active participation in the classroom		
10.6 Minimum performance standards			
➢ At least grade 5 (from a scale of 1 to 10) at written exam			

Date	Signature of course coordinator	Signature of seminar coordinator
30.04.2019	Prof.Dr.Dorin Andrica	Prof.Dr.Dorin Andrica

Date of approval

Signature of the head of department

Prof.Dr.Octavian Agratini