SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	Babeş-Bolyai University Cluj-Napoca
1.2 Faculty	Faculty of Mathematics and Computer Science
1.3 Department	Department of Mathematics
1.4 Field of study	Mathematics
1.5 Study cycle	Bachelor of Science
1.6 Study programme / Qualification	Mathematics and Computer Science

2. Information regarding the discipline

2.1 Name of the discipline			Topology				
2.2 Course coordinator			Conf. dr. Adriana Nicolae				
2.3 Seminar coordinator			Conf. dr. Adriana Nicolae				
2.4. Year of study	2	2.5 Semester	3	2.6. Type of evaluation	VP	2.7 Type of discipline	Optional

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

3.1 Hours per week	4	Of which: 3.2 course	2	3.3 seminar/laboratory	2
3.4 Total hours in the curriculum	56	Of which: 3.5 course	28	3.6 seminar/laboratory	28
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					30
Additional documentation (in libraries, on electronic platforms, field documentation)					14
Preparation for seminars/labs, homework, papers, portfolios and essays					20
Tutorship					10
Evaluations					20
Other activities					-
3.7 Total individual study hours	94				
3.8 Total hours per semester	150				
3.9 Number of ECTS credits	6				

4. Prerequisites (if necessary)

4.1. curriculum	• Calculus 1, 2
4.2. competencies	• Analytic thinking

5. Conditions (if necessary)

5.1. for the course	• Lecture hall equipped with blackboard
5.2. for the seminar /lab activities	• Classroom equipped with blackboard

6. Specific competencies acquired

Professional competencies	• C1.1 Identification of notions, description of theories and use of specific language. • C1.4 Recognition of main classes/types of mathematical problems and of appropriate techniques for solving them. • C5.2 Use of mathematical arguments to prove mathematical results.
Transversal competencies	• CT1 Application of efficient and rigorous working rules by adopting responsible attitudes towards the scientific and didactic fields for the development of the own creative potential respecting professional and ethical principles.

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

7.1 General objective of the discipline	• To acquire fundamental knowledge about general topology and to apply it in solving problems.
7.2 Specific objective of the discipline	• To acquire knowledge about elements of general topology (e.g., metric spaces, topological spaces, continuity, separation axioms, connectedness, compactness) and about important results in topology (e.g., the Urysohn Lemma, the Tietze Extension Theorem, the Arzelà-Ascoli Theorem, the Stone-Weierstrass Theorem).

8. Content

8.1 Course	Teaching methods	Remarks
1. Introduction: fundamental problems in topology. Metric spaces, examples	Lecture, discussion, didactical demonstration, problematisation	
2. Open sets in metric spaces. Topological spaces, examples. Neighborhoods, convergent sequences	Lecture, discussion, didactical demonstration, problematisation	
3. Interior, closure, and boundary. Bases, subbases of topologies	Lecture, discussion, didactical demonstration, problematisation	
4. Generated topology, subspace, product space, quotient space, examples	Lecture, discussion, didactical demonstration, problematisation	
5. Countability properties. Continuous functions (I)	Lecture, discussion, didactical demonstration, problematisation	
6. Continuous functions (II). Separation axioms	Lecture, discussion, didactical demonstration, problematisation	
7. The Urysohn Lemma and the Tietze Extension Theorem	Lecture, discussion, didactical demonstration, problematisation	
8. Uniformly continuous, Lipschitz, and Hölder functions	Lecture, discussion, didactical demonstration, problematisation	
9. Complete metric spaces	Lecture, discussion, didactical demonstration, problematisation	
10. Connectedness	Lecture, discussion, didactical demonstration, problematisation	
11. Compactness	Lecture, discussion, didactical demonstration, problematisation	
12. Compactness in metric spaces	Lecture, discussion, didactical demonstration, problematisation	
13. Spaces of continuous functions. The Arzelà - Ascoli Theorem	Lecture, discussion, didactical demonstration, problematisation	
14. The Stone-Weierstrass Theorem	Lecture, discussion, didactical demonstration, problematisation	

Bibliography

1. V. Anisiu, Topologie şi teoria măsurii, Universitatea "Babeş-Bolyai", Cluj-Napoca, 1993.
2. R. Engelking, General topology, 2nd ed., Heldermann Verlag, Berlin, 1989.
3. G. B. Folland, Real analysis. Modern techniques and their applications, 2nd ed., John Wiley & Sons, Inc., New York, 1999.
4. J. L. Kelley, General topology. Reprint of the 1955 edition [Van Nostrand, Toronto, Ont.], Springer, New York-Berlin, 1975.
5. J. R. Munkres, Topology, 2nd ed., Prentice Hall, Inc., Upper Saddle River, NJ, 2000.
6. B. Simon, A comprehensive course in analysis. Part 1: Real analysis, American Mathematical Society, Providence, RI, 2015.
7. S. Willard, General topology, Addison-Wesley Publishing Co., Reading, Mass.-London-Don Mills, Ont., 1970.

8.2 Seminar	Teaching methods	Remarks
1. Introduction: fundamental problems in topology. Metric spaces, examples	Discussion, problem solving, didactical demonstration	
2. Open sets in metric spaces. Topological spaces, examples. Neighborhoods, convergent sequences	Discussion, problem solving, didactical demonstration	
3. Interior, closure, and boundary. Bases, subbases of topologies	Discussion, problem solving, didactical demonstration	
4. Generated topology, subspace, product space, quotient space, examples	Discussion, problem solving, didactical demonstration	
5. Countability properties. Continuous functions (I)	Discussion, problem solving, didactical demonstration	
6. Continuous functions (II). Separation axioms	Discussion, problem solving, didactical demonstration.	
7. The Urysohn Lemma and the Tietze Extension Theorem	Discussion, problem solving, didactical demonstration	
8. Uniformly continuous, Lipschitz, and Hölder functions	Discussion, problem solving, didactical demonstration	
9. Complete metric spaces	Discussion, problem solving, didactical demonstration	
10. Connectedness	Discussion, problem solving, didactical demonstration	
11. Compactness	Discussion, problem solving, didactical demonstration	
12. Compactness in metric spaces	Discussion, problem solving, didactical demonstration	
13. Spaces of continuous functions. The Arzelà - Ascoli Theorem	Discussion, problem solving, didactical demonstration	
14. The Stone-Weierstrass Theorem	Discussion, problem solving, didactical demonstration	

Bibliography (in addition to the books mentioned before which also contain exercises)

1. A. V. Arkhangel′skiĭ, V. I. Ponomarev, Fundamentals of general topology: Problems and exercises, D. Reidel Publishing Co., Dordrecht, 1984.
2. O. Ya. Viro, O. A. Ivanov, N. Yu. Netsvetaev, V. Kharlamov, Elementary topology. Problem textbook, American Mathematical Society, Providence, RI, 2008.

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 course ensures a solid theoretical background, according to national and international standards. This discipline is useful in preparing future teachers and researchers in mathematics, but is also addressed to those who use various modern mathematical methods and techniques in other areas.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade
10.4 Course	- Knowledge of basic notions, examples and results - Ability to prove theoretical results	- Homework assignments, test - Lecture and seminar activity	- Homework assignments: 30% - Test: 70% - Lecture and seminar activity: bonus max. 3%
10.5 Seminar/lab activities	- Problem solving using concepts and results		

	acquired during the lecture classes - Attendance according to the rules of the faculty		
10.6 Minimum performance standards			
Both the grade at the test and the final average should be at least 5.			

Date	Signature of course coordinator	Signature of seminar coordinator
20.04.2021	Conf. dr. Adriana Nicolae	Conf. dr. Adriana Nicolae

Date of approval	Signature of the head of department
28.04.2021	Prof. dr. Octavian Agratini