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	Computer Science
1.5 Study cycle	Bachelor of Science
1.6 Study programme / Qualification	Computer Science

2. Information regarding the discipline

2.1 Name of the discipline			Mathematical Analysis				
2.2 Course coordinator			Prof. Nicolae Popovici, Ph.D. habil.				
2.3 Seminar coordinator			Prof. Nicolae Popovici, Ph.D. habil.				
2.4. Year of study	1	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	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)					10
Preparation for seminars/labs, homework, papers, portfolios and essays					20
Tutorship					14
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	• High-school calculus
4.2. competencies	• Computing limits, derivatives and antiderivatives • Analytic thinking

5. Conditions (if necessary)

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

6. Specific competencies acquired

Professional competencies	• To understand, in-depth, some concepts and results of mathematical analysis. • Ability to use mathematical methods for solving practical problems
Transversal competencies	To apply rigorous and efficient work rules, by adopting a responsible attitude towards the scientific and didactic activities. To develop the own creative potential in specific areas, following the professional ethical norms and principles.

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

7.1 General objective of the discipline	To acquire elementary knowledge about differential and integral calculus for real-valued functions of one or several real variables
7.2 Specific objective of the discipline	Students should acquire knowledge about: • Sequences and series of real numbers, • Power series; • Limits of functions; • Partial derivatives and the differential; • Extremum points • Riemann integrals, improper integrals, multiple integrals

8. Content

8.1 Course	Teaching methods	Remarks
1. The real numbers: some basic concepts	Direct instruction, mathematical proof, exemplification	
2. Sequences of real numbers	Direct instruction, mathematical proof, exemplification	
3. Series of real numbers; Series with nonnegative terms (I)	Direct instruction, mathematical proof, exemplification	
4. Series with nonnegative terms (II); Alternating series	Direct instruction, mathematical proof, exemplification	
5. Limits, continuity and differentiation of real-valued functions of one real variable	Direct instruction, mathematical proof, exemplification	
6. Higher order derivatives; Taylor series and power series	Direct instruction, mathematical proof, exemplification	
7. The Riemann integral; Improper integrals	Direct instruction, mathematical proof, exemplification	
8. The Euclidean (topological) space R^n; Sequences of points in R^n	Direct instruction, mathematical proof, exemplification	
9. Limits and continuity of real-valued functions of several variables	Direct instruction, mathematical proof, exemplification	
10. Partial derivatives and the differential	Direct instruction, mathematical proof, exemplification	

11. Local extremum points for real-valued functions of several variables	Direct instruction, mathematical proof, exemplification	
12. Double integrals	Direct instruction, mathematical proof, exemplification	
13. Triple and multiple integrals	Direct instruction, mathematical proof, exemplification	
14. Change of variables	Direct instruction, mathematical proof, exemplification	

Bibliography

1. R.G. Bartle, D.R. Sherbert, Introduction to Real Analysis, 4th ed., John Wiley & Sons Inc., New York, 2011.
2. W.W. Breckner, Analiză matematică. Topologia spaţiului $\mathbb{R}^n$, Universitatea din Cluj-Napoca, Cluj-Napoca, 1985.
3. Ş. Cobzaş, Analiză matematică - Calculul diferenţial, Presa Universitară Clujeană, Cluj-Napoca, 1997.
4. M. Mureşan, A Concret Approach to Classical Analysis, Springer, New York, 2008.
5. M. Oberguggenberger, A. Ostermann, Analysis for Computer Scientists, Foundations, Methods, and Algorithms, Springer, London, 2011.
6. W. Rudin, Principles of Mathematical Analysis, 3rd ed., McGraw-Hill Inc., New York, 1976.

8.2 Seminar / laboratory	Teaching methods	Remarks
1. Classical inequalities and other properties of real numbers	Problem-based instruction, debate, mathematical proofs	
2. Sequences of real numbers	Problem-based instruction, debate, mathematical proofs	
3. Computing the sum of some series of real numbers	Problem-based instruction, debate, mathematical proofs	
4. Convergence/divergence of some series of real numbers	Problem-based instruction, debate, mathematical proofs	
5. Limits, continuity and differentiation of real-valued functions of one real variable	Problem-based instruction, debate, mathematical proofs	
6. Higher order derivatives; Taylor series and power series	Problem-based instruction, debate, mathematical proofs	
7. Riemann integrals	Problem-based instruction, debate, mathematical proofs	
8. Improper integrals	Problem-based instruction, debate, mathematical proofs	
9. The topology of the space R^n	Problem-based instruction, debate, mathematical proofs	
10. Limits and continuity of real-valued functions of several variables	Problem-based instruction, debate, mathematical proofs	
11. Partial derivatives and the differential	Problem-based instruction, debate, mathematical proofs	
12. Local and global extremum points of real-valued functions	Problem-based instruction, debate, mathematical proofs	
13. Multiple integrals	Problem-based instruction, debate, mathematical proofs	
14. Change of variables	Problem-based instruction, debate, mathematical proofs	

Bibliography
1. D.I. Duca, E. Duca, Exerciţii şi probleme de analiză matematică, vol. I, II, Casa Cărţii de Ştiinţă, Cluj-Napoca, 2007, 2009. 2. W.J. Kaczor, M.T. Nowak, Problems in Mathematical Analysis, vol. I, II, III, American Mathematical Society, 2000, 2001, 2003. 3. T. Trif, Probleme de calcul diferenţial şi integral în R^n, Casa Cărţii de Ştiinţă, Cluj-Napoca, 2003.

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

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	- Knowledge of theoretical concepts and theoretical results; - Ability to solve practical exercises and theoretical problems	Final written exam	75%
10.5 Seminar/lab activities	Problem solving	Midterm test	25%
10.6 Minimum performance standards			
The final grade should be greater than or equal to 5.			

Date	Signature of course coordinator	Signature of seminar coordinator
22.04.2018	Prof. Nicolae Popovici, Ph.D. habil.	Prof. Nicolae Popovici, Ph.D. habil.

Date of approval	Signature of the head of department
....	Prof. Octavian Agratini, Ph.D.