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			Lect. dr. Adriana Nicolae				
2.3 Seminar coordinator			Lect. dr. Adriana Nicolae				
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 with blackboard and chalk
5.2. for the seminar /lab activities	• Classroom with blackboard and chalk

6. Specific competencies acquired

Professional competencies	• C3.1 Description of concepts, theories and models used in the application field • C4.3 Identification of appropriate models and methods for solving real-life problems
Transversal competencies	• CT3 Use of efficient methods and techniques for learning, information, research and development of abilities for the valorization of acquired knowledge, for adapting to the needs of a dynamic society and for communication in Romanian as well as in a widely used foreign language

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 and several real variables and to apply it in solving concrete problems
7.2 Specific objective of the discipline	• To know and use the following specific notions: convergent series of real numbers, power series, limits of functions, partial derivatives, extremum points, improper integrals, double integrals

8. Content

8.1 Course	Teaching methods	Remarks
1. The real numbers: some basic concepts	Lecture, discussion, didactical demonstration, problematisation	
2. Sequences of real numbers	Lecture, discussion, didactical demonstration, problematisation	
3. Series of real numbers. Series with nonnegative terms (I)	Lecture, discussion, didactical demonstration, problematisation	
4. Series with nonnegative terms (II). Alternating series	Lecture, discussion, didactical demonstration, problematisation	
5. Limits, continuity and differentiation of real-valued functions of one real variable	Lecture, discussion, didactical demonstration, problematisation	
6. Higher order derivatives. Taylor series and power series. Operations with power series	Lecture, discussion, didactical demonstration, problematisation	
7. The Riemann integral	Lecture, discussion, didactical demonstration, problematisation	
8. Improper integrals	Lecture, discussion, didactical demonstration, problematisation	
9. The topology of the space $\mathbb{R}^n$	Lecture, discussion, didactical demonstration, problematisation	
10. Sequences in $\mathbb{R}^n$. Limits and continuity of real-valued functions of several variables	Lecture, discussion, didactical demonstration, problematisation	
11. Partial derivatives and the differential	Lecture, discussion, didactical demonstration, problematisation	
12. Local extremum points for real-valued functions of several variables	Lecture, discussion, didactical demonstration, problematisation	

13. Double integrals	Lecture, discussion, didactical demonstration, problematisation	
14. Change of coordinates in the plane	Lecture, discussion, didactical demonstration, problematisation	

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. Real numbers	Discussion, problem solving, didactical demonstration	
2. Sequences of real numbers	Discussion, problem solving, didactical demonstration	
3. Computing the sum of some series of real numbers	Discussion, problem solving, didactical demonstration.	
4. Convergence/divergence of some series of real numbers	Discussion, problem solving, didactical demonstration	
5. Limits, continuity and differentiation of real-valued functions of one real variable	Discussion, problem solving, didactical demonstration	
6. Higher order derivatives. Taylor series and power series	Discussion, problem solving, didactical demonstration	
7. Riemann integrals	Discussion, problem solving, didactical demonstration	
8. Improper integrals	Discussion, problem solving, didactical demonstration	
9. The topology of the space $\mathbb{R}^n$	Discussion, problem solving, didactical demonstration	
10. Limits and continuity of real-valued functions of several variables	Discussion, problem solving, didactical demonstration	
11. Partial derivatives and the differential	Discussion, problem solving, didactical demonstration	
12. Extremum problems	Discussion, problem solving, didactical demonstration	
13. Double integrals	Discussion, problem solving, didactical demonstration	
14. Change of coordinates in the plane	Discussion, problem solving, didactical demonstration	

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 $\mathbb{R}^n$, 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 content of this course is synchronized with the curriculum of important universities (both from Romania and abroad) which have study programs where a solid mathematical foundation is essential.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	To know basic notions, examples and results and to be able to apply them in solving concrete problems	Final written exam	65%
10.5 Seminar/lab activities	Problem solving	Midterm test	35%
10.6 Minimum performance standards			
• To obtain at least 5 (out of 10) points at the final written exam and an overall minimum of 5 (out of 10) points			

Date	Signature of course coordinator	Signature of seminar coordinator
12.04.2016	Lect. dr. Adriana Nicolae	Lect. dr. Adriana Nicolae

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