SYLLABUS

1. Information regarding the programme

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

2. Information regarding the discipline

2.1 Name of the discipline Calculus							
2.2 Course coordinator Conf. dr. Breckner Brigitte							
2.3 Seminar coordinator				Conf. dr. Breckner Brigitte			
2.4. Year of	1	2.5	1	2.6. Type of	Written	2.7 Type of	compulsory
study		Semester		evaluation	Exam	discipline	

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

3.1 Hours per week	4	Of which: 3.2 course	2	3.3	2
				seminar/laboratory	
3.4 Total hours in the curriculum	4	Of which: 3.5 course	2	3.6	2
				seminar/laboratory	
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					34
Additional documentation (in libraries, on electronic platforms, field documentation)					20
Preparation for seminars/labs, homework, papers, portfolios and essays					20
Tutorship					10
Evaluations					10
Other activities:				-	
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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	 Logical thinking abilities

5. Conditions (if necessary)

5.1. for the course	•
5.2. for the seminar /lab	•
activities	

6. Specific competencies acquired

or Specia	ie competencies acquirea
	C4.1 Defining basic concepts, theory and mathematical models
Professional competencies	C4.2 Interpretation of mathematical models C4.3 Identifying the appropriate models and methods for solving real-life problems C4.5 Embedding formal models in applications from various areas
	CT1 Application of efficient and rigorous working rules, manifest responsible attitudes
Transversal competencies	towards the scientific and didactic fields, respecting the professional and ethical principles. CT3 Use of efficient methods and techniques for learning, information, research and
ver	
ınsı	development of abilities for knowledge acquiring, for adapting to the needs of a dynamic
Transversal	society and for communication in Romanian as well as in a widely used foreign language.
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7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	 Acquiring knowledge about the algebraic and topological structure of the Euclidean space IRⁿ and the basic notions and results concerning the differential and integral calculus of real-valued functions of several real variables.
7.2 Specific objective of the discipline	Representation of the algebraic and topological structure of the Euclidian space R^n. Study of secure as of reals and of infinitely series of reals.
	 Study of sequences of reals and of infinitely series of reals. Sequences in R^n. Differential and integral calculus in R and R^n.

8. Content

8.1 Course	Teaching methods	Remarks
1. The system of real numbers (upper and lower	Lecture, discussion,	
bound of a set; minimum and maximum of a	problematisation.	
set; infimum and supremum of a set; the		
infimum principle, the supremum principle and		
its consequences; the sets of natural numbers,		
the set integer numbers, the set of rational		
numbers, and the set of irrational numbers; the		
extended set of real numbers).		
2. The set of real numbers (absolute value and	Lecture, discussion,	
distance; neighborhood of a point). Sequences	problematisation.	
of real numbers (definition of the limit and its		
characterizations; uniqueness of the limit;		
subsequence of a sequence; sandwich theorem;		
the connection between the existence of the		
limit of a sequence and the boundedness of the		
sequence).		
3. Sequences of real numbers (existence of the	Lecture, discussion,	
limit for monotone sequences; applications: the	problematisation.	
irrational number e; fundamental sequences;		
Cauchy's convergence criterion). Series of real		

convergent series; properties of convergent series). 4. Series of real numbers (convergence/divergence criteria for series; Cauchy's general criterion, Comparison criteria, the root criterion, Comparison criteria, the root criterion (Comparison criteria, the root criterion, Comparison criteria, the root criterion (Comparison criteria), absolutely convergent series; the Leibniz criterion for alternant series). 5. Real-valued functions of a single real variable (limits; continuous functions; differentiable functions). 6. Real-valued functions of a single real variable (primitives and indefinite integrals; Riemann integrability). 7. Real-valued functions of a single real variable (improper integrals); convergence criteria for improper integrals; convergence criteria for improper integrals; convergence criteria for improper integrals. 8. The euclidean space R'n (algebraic structure; inner product and norm; topological structure). 9. Sequences in R'n (limit of a sequence; operations with convergent sequences). Real-valued functions of several real variables (limits; operations with continuous functions; Weierstrass' theorem). 10. Vector-valued functions of several real variables (limits; operations with continuous functions of a single real variable; the mean value theorem for vector-valued functions of a single real variable; the mean value theorem for vector-valued functions; the Schwarz theorem). 12. Differential calculus in R'n (first order and higher order partial derivatives of real-valued functions of several real variables; the mean value theorem; operations with differentiable functions; second order differentiablity of real-valued functions of several real variables; the mean value theorem; operations with differentiablity of real-valued functions of several real variables; the mean value theorem; operations with differentiablity of real-valued functions of several real variables; the mean value theorem; operations with dinferentiablity of real-valued functions of several real variables; the mean v		T
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8.2 Seminar / laboratory	Teaching methods	Remarks
1. The system of real numbers (upper and lower	Discussion, problem	
bound of a set; minimum and maximum of a	solving, self-study,	
set; infimum and supremum of a set) and the	team work.	
induction principle.		
2. Sequences of reals (operations with convergent	Discussion, problem	
sequences; typical examples for	solving, self-study,	
convergent/divergent sequences; computation	team work.	
of limits). 3. Series of reals (the irrational number e as the	Discussion, problem	
sum of some remarkable series; telescopical	solving, self-study,	
series; computation of the sum of concrete	team work.	
series of reals).	team work.	
4. Series of reals (application of the presented	Discussion, problem	
convergence/divergence criteria to check the	solving, self-study,	
convergence/divergence of some series).	team work.	
5. Real-valued functions of a single real variable	Discussion, problem	
(limits; continuous functions; differentiable	solving, self-study,	
functions).	team work.	
6. Real-valued functions of a single real variable	Discussion, problem	
(primitives and indefinite integrals; Riemann	solving, self-study,	
integrability).	team work.	
7. Real-valued functions of a single real variable	Discussion, problem	
(improper integrals: convergence criteria for	solving, self-study,	
improper integrals).	team work.	
8. Exercises and problems related to the algebraic	Discussion, problem	
and topological structure of R^n.	solving, self-study, team work.	
9. Limits of sequences in R^n. Real-valued	Discussion, problem	
functions of several real variables (limits,	solving, self-study,	
continuity).	team work.	
10. Vector-valued functions of several real	Discussion, problem	
variables (limits; continuity). Differential	solving, self-study,	
calculus in R^n (the derivative of a vector-	team work.	
valued function of a single real variable).		
11. Differential calculus in R^n (first order and	Discussion, problem	
higher order partial derivates of real-valued	solving, self-study,	
functions of several real variables).	team work.	
12. Differential calculus in R^n (the chain rule).	Discussion, problem	
	solving, self-study,	
10.0	team work.	
13. Computing local optima of real-valued	Discussion, problem	

functions of several real variables.	solving, self-study,
	team work.
14. Computing double and triple integrals over	Discussion, problem
compact intervals.	solving, self-study,
	team work.

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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 designed to satisfy the expectations of several networks of professionals of recognised expertise. The results of our students validate this statement.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	Exam	Written exam	60%
10.5 Seminar/lab activities	Continuous evaluation	Evaluation of the weekly	20%
		activity	
	Midterm test (compulsory)	Midterm test	20%
10.6 Minimum performance	e standards 5		
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Date	Signature of course coordinator	Signature of seminar coordinator	
28.04.2015	Conf. dr. Brigitte Breckner	Conf. dr. Brigitte Breckner	
Date of approval	Signature of	Signature of the head of department	
	Prof dr Octavian Agratini		