M094	**Real Analysis**	L	S	E	ECTS
		3	0	2	7

Course objective. The knowledge pertaining to the courses *Differential Calculus*, *Integral Calculus* and *Functions of Several Variables* will be broadened in a *mathematically formal* way.

Course prerequisites. Differential Calculus, Integral Calculus,
Functions of Several Variables (or Applied Mathematics for Computer Science).

Syllabus.

1. Basic of topology. Euclidean space $\mathbf{R}^n$. Euclidean norm on $\mathbf{R}^n$. Equivalent norms. Euclidean metric on $\mathbf{R}^n$. Topology on $\mathbf{R}^n$. Basic concepts of abstract metric and topological spaces (topological structure, closure of a set, boundary of a set, an accumulation point, a dense set, relative topology).

2. Sequences**.** Sequences of real numbers. Limit superior and limit inferior. Sequences in $\mathbf{R}^n$. Subsequences. Convergence of sequences. Bolzano-Weierstrass theorem. Sequences in metric and topological spaces. On uniqueness of the limit in topological space. Closed sets in terms of limits of convergent sequences. Cauchy sequences. Complete metric spaces.

3. Compactness. Compactness in $\mathbf{R}^n$. Compactness in metric spaces. The Lebesgue number. The Heine-Borel theorem.

4. Continuous mappings. Cauchy's, Heine's and topological definition of continuity of a vector-valued function of several real variables. Properties of continuous functions. Connected space and a path connected space. The continuous function defined on a compact set and some applications (Weierstrass theorem, equivalence of norms in $\mathbf{R}^n$, etc.). Uniform continuity. Lipschitz functions. Banach fixed-point theorem.

5. Limit of the function. Cauchy's, Heine's and topological definition of the limit of a function. Properties of limits.

EXPECTED LEARNING OUTCOMES

No.	**LEARNING OUTCOMES**
1.	Understand basic concepts and properties of Euclidean, metric and topological spaces.
2.	Understand well sequences in metric and topological space.
3.	Know and understand the concepts of continuous functions, uniform continuity of functions, convergence of a sequence of functions and limit of the function.
4.	Become familiar with compact sets and basic properties of continuous mappings defined on the compact.
5.	Understand and reproduce the correct mathematical proof of claim applying basic forms of mathematical and logical inference.

COUPLING OF THE LEARNING OUTCOMES, TEACHING PROCESS ORGANIZATION AND THE EVALUATION OF THE TEACHING OUTCOMES

TEACHING PROCESS ORGANIZATION	ECTS	LEARNING OUTCOMES **	STUDENT ACTIVITY*	EVALUATION METHOD	SCORE	
					Min	max
Lecture attendance	1	1-5	Lecture attendance, discussion, team work and independent work on given tasks.	Attendance sheets, tracking activities	0	4
Written exam. (preliminary exam)	3	1-5	Preparing for written exam.	Evaluation.	25	48
Final exam.	3	1-6	Revision of the subject matter.	Oral exam.	25	48
Total	7				50	100

Teaching methods and student assessment. Lectures and exercises are obligatory. Final examination consists of both a written and oral part that can be taken after the completion of all lectures and exercises. During the semester, students can take mid-term exams that replace the written examination.

Can the course be taught in English: Yes.

Basic literature:

1. Š. Ungar, Matematička analiza III, Matematički odjel PMF, Zagreb 1994.
2. Reviewed course materials available on the website of the course.

Recommended literature:

1. S. Mardešić, Matematička analiza u n-dimenzionalnom realnom prostoru I, Školska knjiga, Zagreb, 1977.
2. W. Rudin, Principles of Mathematical Analysis, Mc Graw-Hill, Book Company, 1964.
3. S. Kurepa, Matematička analiza 1 (diferenciranje i integriranje), Tehnička knjiga, Zagreb, 1989.
4. S. Kurepa, Matematička analiza 2 (funkcije jedne varijable), Tehnička knjiga, Zagreb, 1990.