M084	Obligatory Semester 1	**Differential Calculus**	P	S	E	ECTS
			4	0	3	8

Course objectives. At the introductory level, the goal of the course is to introduce students to fundamental ideas and methods of mathematical analysis, which are the basis for many other courses. During lectures, basic concepts and their usefulness and applications will be considered. During exercises, students should apply appropriate techniques and solve specific problems. Programme is the same for all branches.

Course prerequisites. High school knowledge.

Course content.

1. Introduction. Field of real numbers, infimum and supremum of a set, absolute value, intervals.
2. Functions. Notion of a function. Domain, codomain, range of a function. Preimage. Graph of a function. Equality of functions. Restriction and extension of a function. Injective function. Surjective function. Bijective function. Composite function. Inverse function. Elementary functions (polynomials, rational functions and irrational functions, exponential and logarithmic functions, trigonometric and inverse trigonometric functions).
3. Sequences. Notion of sequence and subsequence, the main properties and convergence. Number e.
4. Limit and function continuity. Notion of function limit. Limits properties. One-sided limits. Infinite limits and limits in the infinity. Asymptotes. Continuity and continuous function properties. Uniform continuity.
5. Differential calculus. The tangent and velocity problem. Notion of derivative. Differentiation rules. Derivatives of elementary functions. Implicit function derivative. Derivative of parametric function. Higher order derivatives. The fundamental theorems of differential calculus.
6. Differential calculus applications. Notion of differential. L'Hôspital's rule. Function analysis (monotonicity, extremes, convexity, asymptotes).

LEARNING OUTCOMES

No	LEARNING OUTCOMES
1.	Differentiate between and give typical examples of convergent and divergent sequences of real numbers, continuous and discontinuous functions, differentiable and non-differentiable real functions of one variable.
2.	Apply the techniques for computing: the limit of real number sequences, limits and derivatives of real functions of one variable.
3.	Recognise the conditions on the functions which enable the application of fundamental theorems of differential calculus and give the appropriate geometrical interpretation.
4.	Interpret the results of the application of differential calculus to simpler optimisation problems.
5.	Understand and reproduce the correct mathematical proof of claim applying basic forms of mathematical and logical inference.
6.	Use mathematics literature from various sources and apply at least one programming tool for illustration of different examples.

RELATING THE LEARNING OUTCOMES, ORGANIZATION OF THE EDUCATIONAL PROCESS AND ESTIMATION OF THE LEARNING OUTCOMES

Organization of the educational process	ECTS	Learning outcomes **	Student activities*	The method of estimate	Points	
					Min	max
Lecture attendance	1	1-6	Lecture attendance, discussion, team work and independent work on given tasks	Attendance sheets, tracking activities	0	4
Written exam (preliminary exm)	3	1-6	Prepairing for written exam	Evaluation	25	48
Final exam.	4	1-6	Repetition of the subject matter	Oral exam	25	48
Total	8				50	100

Teaching methods and student assessment. Lectures and exercises are obligatory. The exam consists of a written and oral part. After the completion of lectures and exercises students can take the exam. Acceptable mid-term exam scores replace the written examination.

Can the course be taught in English: Yes.

Basic literature:

1. D. Jukić, R. Scitovski, Matematika I, Odjel za matematiku, Osijek, 2000.
2. J. Stewart, Calculus, 7th Edition, McMaster University and University of Toronto, Brooks/Cole, Cengage Learning, Belmont, 2008.

Recommended literature:

1. B. P. Demidovič, Zadaci i riješeni primjeri iz više matematike s primjenom na tehničke nauke, Tehnička knjiga, Zagreb, 1986.
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.