M093	Elective Year 2	**Applications of Differential and Integral Calculus I**	P	S	E	ECTS
			1	0	2	4

Course objectives. To introduce students with applications of basic notations and techniques considered in the course Differential and Integral Calculus. Different problems in connection with applications in various areas such as physics, economics, biology and chemistry will be considered.

Course prerequisites. Differential Calculus. Integral Calculus.

Syllabus.

1. Differential calculus. Differentiation and applications in physics (velocity, acceleration), economy (marginal costs and revenues, the rate of change in demand and supply, elasticity), biology (rate of growth of a living organism with and without restriction) and chemistry (the rate of chemical reaction). Parametric and polar function and its derivative. Vector-valued function of a scalar argument and derivative. Implicit functions and derivative. Some applications (tangent line, normal line, curvature, evolutes). Extremes of functions of one variable with various applications in physics, economy, biology and chemistry. Derivation of physical laws and equations (e.g., Kepler's laws from Newton's second law of motion and the law of gravity).
2. Integral calculus. The problem of calculating the surface area bounded by the graph function. Length arcs. Calculating the surface area and the volume of a solid obtained by rotating the curve. Integral of the vector-valued function of a scalar argument. Applications of the definite integral in physics (hydrostatic pressure and force, moments and the centre of mass of a thin plate with uniform density, forces energy and work).

EXPECTED LEARNING OUTCOMES

No	LEARNING OUTCOMES
1.	Understand and reproduce different interpretations of derivatives that come from geometry, physics, economics, biology, chemistry, etc.
2.	Identify optimisation problems in geometry, physics, economics, biology, chemistry, etc., which can be reduced to the problem of minimizing differentiable functions of one variable and apply them to differential calculus and interpret appropriate results;
3.	Identify problems in various fields of application, which can be reduced to the problem of computing definite integrals, and apply them to the calculation of definite integrals techniques and interpret the corresponding results;
4.	Understand and reproduce the correct mathematical proof of claim by applying basic forms of mathematical and logical inference;
5.	Use the mathematical literature from various sources and apply at least one programming tool for illustration of different examples.

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

TEACHING PROCESS ORGANIZATION	ECTS	LEARNING OUTCOMES **	STUDENT ACTIVITIES*	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)	1	1-5	Prepairing for written exam.	Evaluation.	25	48
Final exam.	2	1-5	Repetition of the subject matter.	Oral exam.	25	48
Total	4				50	100

Teaching methods and student assessment. Lectures and exercises are obligatory. The exam consists of a written and an 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.
3. B. P. Demidovič, Zadaci i riješeni primjeri iz više matematike s primjenom na tehničke nauke, Tehnička knjiga, Zagreb, 1986.

Recommended literature:

1. W. Rudin, Principles of Mathematical Analysis, Mc Graw-Hill, Book Company, 1964.
2. S. Kurepa, Matematička analiza 1 (diferenciranje i integriranje), Tehnička knjiga, Zagreb, 1989.
3. S. Kurepa, Matematička analiza 2 (funkcije jedne varijable), Tehnička knjiga, Zagreb, 1990.
4. M. Lovrić, Vector Calculus, Addison-Wesley Publ. Ltd., Don Mills, Ontario, 1997.
5. J. D. Murray, Mathematical Biology I: An introduction, New York, Springer, 2002.