

I027	<b>Mathematical Tools</b>	L	S	E	ECTS
		1	0	2	

**Course objectives:** Practical introduction of students to the usage of tools which mathematicians need in everyday's work in modern teaching and profession, as well as in scientific work. Emphasis will be on the use of integrated functions, but also in the development of customized elements. During the course the examples of the use of mathematical tools to solve various problems in applied mathematics will be illustrated.

**Prerequisites.** Introduction to Computer Science, Differential Calculus, Integral Calculus, Linear Algebra I, Linear Algebra II

### Syllabus.

1. **LaTeX.** Basics about LaTeX. Text editing. Writing mathematical formulae. Graphics. Preparing large documents. LaTeX presentations.
2. **Mathematica.** Kernel, GUI interface, Notebook. Basic elements and symbolic computation. Built-in functions. Mathematica as a programming language. Graphics and dynamic elements. Application to some concrete mathematical problems.
3. **MATLAB.** Calculations with matrices. Overview of integrated functions. Programming in MATLAB. Graphics. Application to some concrete linear algebra problems.

### Learning outcomes

No.	Learning outcomes
1.	The ability of independent writing of mathematical expressions in LaTeX.
2.	Readiness for the preparation of larger documents in LaTeX.
3.	Mastering the use of built-in elements in Mathematica package for different symbolic mathematical calculations.
4.	The ability to make simple programs using Mathematica package.
5.	Mastering the use of built-in functions in MATLAB for various numerical calculations.
6.	The ability to create new functions in MATLAB
7.	The ability to use MATLAB and Mathematica for visualization.

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

TEACHING PROCESS ORGANIZATION	ECT S	EXPECTED LEARNING OUTCOMES **	STUDENT ACTIVITY *	EVALUATION METHOD	SCORE	
					min	max
Lecture attendance	0.5	1-7	Attending lectures, discussions, teamwork and individual work on computers	Participant lists, monitoring activities on class	0	5

Homework	0.5	1-7	Independent problem solving	Checking the correctness of solutions (scoring)	10	15
Repeated exams	1	1-7	Preparation for midterms	Checking the correctness of solutions (scoring)	20	40
Final exam	2	1-7	Recapitulation of the subject matter	Oral exam	20	40
TOTAL	4				50	100

### Teaching methods and student assessment.

Lectures and exercises are obligatory. Exercises are partially auditory and partially laboratory with use of computers. During the semester students will be assigned homeworks. The exam is taken after the completion of lectures, exercises and homeworks. It consists of a written and oral part. Acceptable results achieved in mid-term exams taken during the semester replace the written part of the exam.

**Can the course be taught in English: Yes.**

#### Basic literature:

1. Original manuals for software tools. Contents available on the websites:

Mathematica: Wolfram Research, <http://www.wolfram.com>

MATLAB: The MathWorks, <http://www.mathworks.com>

LaTeX: Ne baš tako kratak uvod u TeX i LaTeX2e

[http://web.math.pmf.unizg.hr/~ungar/lkratko2e\\_internet.pdf](http://web.math.pmf.unizg.hr/~ungar/lkratko2e_internet.pdf)

#### Recommended literature:

1. E. Don, Schaum's Outline of Mathematica, McGraw-Hill Trade, NewYork, 2000.
2. R. Pratap, Getting Started With Matlab: Version 6: A Quick Introduction for Scientists and Engineers, Oxford University Press, NewYork, 2002.
3. R.E. Maeder, Programming in Mathematica, 3/E, Addison-Wesley, Boston, 1995
4. N. Truhar, Numerička linearna algebra, Sveučilište J.J.Strossmayera:Odjel za matematiku, Osijek, 2013.
5. D. J. Higham and N. J. Higham, MATLAB Guide, Second Edition, SIAM, Philadelphia, 2005.