GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Programming and Numerical Methods, PG_00062072						
Field of study	Civil Engineering						
Date of commencement of studies	October 2025		Academic year of realisation of subject	2026/2027			
Education level	first-cycle studies		Subject group	Obligatory subject group in the field of study			
Mode of study	Full-time studies		Mode of delivery	at the university			
Year of study	2		Language of instruction	Polish			
Semester of study	3		ECTS credits	2.0			
Learning profile	general academic profile		Assessment form	assessment			
Conducting unit	Department of Structural Mechanics -> Faculty of Civil and Environmental Engineering -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Marcin Zmuda Trzebiatowski				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	10.0	20.0	0.0	0.0	30
	E-learning hours included: 0.0						
	eNauczanie source address: https://enauczanie.pg.edu.pl/2025/course/view.php?id=7787 Moodle ID: 7787 Programowanie i metody numeryczne https://enauczanie.pg.edu.pl/2025/course/view.php?id=7787						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	30		0.0		0.0	30
Subject objectives	Aim of the subject is to teach advanced programming skills and numerical methods realized with MATLAB software and dedicated to solve fundamental engineering problems.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W04] Knows the rules of descriptive geometry and technical drawing for preparing and reading architectural, construction and geodetic drawings; also with the use of CAD	The student knows the mathematical foundations of geometric system representation and analysis, and is able to interpret spatial data using numerical tools in the MATLAB environment.	[SW1] Assessment of factual knowledge
[K6_W01] Demonstrate knowledge and understanding of mathematics as well as sciences and engineering disciplines underlying civil engineering at a level necessary to achieve the other programme outcomes.	The student has an extended knowledge of programming in the MATLAB environment and understands the principles of applying numerical methods to solve engineering problems.	[SW1] Assessment of factual knowledge
[K6_U04] Reads and prepares construction documentation (including drawings, graphic documentation in the CAD environment), efficiently uses maps as well as architectural, construction and geodetic drawings.	The student is able to process, analyze, and visualize engineering data derived from technical documentation, maps, or CAD models by applying programming, numerical methods, and basic statistical analysis tools in the MATLAB environment.	[SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools
[K6_W05] Demonstrate knowledge and understanding of research methods (obtaining information, simulations, experimental methods) in the field of civil engineering.	The student has an extended knowledge of programming in the MATLAB environment and understands the principles of applying numerical methods and computer simulations as tools for research and analysis of engineering problems.	[SW2] Assessment of knowledge contained in presentation

Subject contents

Course content – exercises

The exercise classes provide theoretical introduction to the topics covered in the laboratory sessions and include student presentations on programming and numerical methods in civil engineering.
Scope:

- Review of MATLAB basics: program structure, basic mathematical operations, creating and editing scripts, and matrix manipulation. Introduction to if, for, and while statements and their use in algorithm development. Principles of user-defined functions.
- Matrix operations: basic matrix and arithmetic operations, data access and indexing, use of matrices in engineering algorithms.
- Advanced graphics and reporting: theoretical background of data visualization plotting, presenting results, creating advanced figures and reports in MATLAB.
- Numerical integration: rectangle, trapezoidal, and Simpsons methods; applications in engineering analysis.
- Interpolation and approximation: fundamentals of polynomial interpolation and least-squares approximation.
- Elements of statistics: basic statistical concepts, random variable distributions, and error analysis.
- Student presentations: selected topics in programming and numerical methods applied in civil engineering.

Course content – laboratory

The laboratory sessions involve the practical application of topics discussed during the exercises in the MATLAB environment. Students work independently, solving engineering problems and developing visualizations of the results.

Scope:

- Review of MATLAB basics: script creation, basic mathematical operations, program structure, and matrix creation and modification. Implementation of basic if, for, and while statements in simple numerical algorithms. Defining user functions.
- Matrix operations: practical use of matrix and arithmetic operations, data access and indexing, and application of matrices in engineering calculation algorithms.
- Advanced graphics and reporting: creating 2D/3D plots and reports, visualizing calculation results, generating complex data presentations in MATLAB.
- Numerical integration: implementation of rectangle, trapezoidal, and Simpsons methods; analysis of results for selected engineering functions.
- Interpolation and approximation: applying polynomial interpolation and least-squares approximation to measurement data.
- Elements of statistics: practical statistical calculations means, standard deviations, and error analysis.

Prerequisites and co-requisites

A completed introductory course in MATLAB programming.

<table>
<tr><td>Assessment methods and criteria</td><td colspan="2"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Presentation</td><td>60.0%</td><td>20.0%</td></tr>
<tr><td>Test</td><td>60.0%</td><td>80.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>1. Podstawy Programowania w języku MATLAB, R. Jankowski, I. Lubowiecka, W. Witkowski, Wyd. PG Gdańsk 2003. MATLAB i jego środowisko, I. Lubowiecka, A. Ambroziak, Wyd. PG Gdańsk 2016.
2. Metody numeryczne w mechanice konstrukcji z przykładami w programie MATLAB, P. Kłosowski, A. Ambroziak, Wyd. PG Gdańsk 2011.</td></tr>
<tr><td>Supplementary literature</td><td>1. Społeczeństwo Informacyjne. Praca zbiorowa pod red. Joanny Papińskiej-Kacperek, PIW, Warszawa 2008.
2. Podstawy technik informatycznych, W. Sikorski, Wydawnictwo Naukowe PWN, Warszawa 2007.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">Calculating the area under a curve from experimental data
Interpolation and approximation of a data set
Generating reports with data and results in textual and graphical form
Statistical analysis of selected data sets</td></tr>
<tr><td>Practical activites within the subject</td><td colspan="2">Not applicable</td></tr>
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