GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00071993		
Field of study	Civil Engineering		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2025/2026
Education level	first-cycle studies	Subject group	
Mode of study	Part-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	3.0
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 hab. inż. Marcin Kujawa	
	Teachers	dr hab. inż. Andrzej Ambroziak mgr inż. Szymon Kalinowski	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	0.0	10.0	10.0	0.0	0.0	20

E-learning hours included: 0.0

eNauczanie source address: https://enauczanie.pg.edu.pl/moodle/course/view.php?id=30271

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	20	0.0	0.0	20

Subject objectives

The aim of the course is to discuss issues related to selected numerical methods in structural mechanics, including: approximation, interpolation, numerical integration, and to teach students the basics of programming in MATLAB in the scope of the numerical methods discussed.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[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 knows the basics of MATLAB programming in the field of numerical methods used in structural mechanics	[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information [SU5] Assessment of ability to present the results of task [SU3] Assessment of ability to use knowledge gained from the subject
[K6_W05] Demonstrate knowledge and understanding of research methods (obtaining information, simulations, experimental methods) in the field of civil engineering.	The student is able to describe and use selected measurement methods for identifying material parameters.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
[K6_U05] Conducts research (obtaining information, simulations, experimental methods) in the field of construction in order to solve specific tasks and report research results.	The student knows: - the syntax and semantics of the programming language, - the types of variables and variable structures and how to declare them, - methods of performing operations on variables/variable structures, - methods of writing scripts and creating and using functions, - methods of conditional execution of program fragments, - methods of controlling the order and number of repetitions of program fragments, - methods of optimizing and debugging program code, - basic programming tools built into MATLAB, allowing, among other things, performing file operations, processing and performing statistical calculations on measurement data, etc., - methods of using specialised, publicly available programming tools for MATLAB (so-called toolboxes)	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task [SU2] Assessment of ability to analyse information
[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 is able to write programs/code fragments in MATLAB that perform specific tasks (e.g., processing measurement data, performing statistical calculations, graphically presenting data, performing file operations, etc.)	[SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects

Subject contents

Course content – exercises
Issues related to selected numerical methods in structural mechanics: approximation, interpolation, numerical integration and programming in MATLAB.

Course content – laboratory
Development of MATLAB programs that perform specific tasks, e.g.: determining internal forces in frame-beam systems; processing measurement data using numerical computer methods; performing statistical calculations, graphical data presentation, performing file operations, etc.

Prerequisites and co-requisites

The condition for taking part in classes is registration for semester 2 of part-time engineering studies.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Exercises: final test	60.0%	50.0%
Laboratory: Project Development and Oral Defense	60.0%	50.0%

Recommended reading

Basic literature	1. P. Kłosowski, A.AMBROZIAK: Metody numeryczne w mechanice konstrukcji z przykładami w programie Matlab - Gdańsk: Wydawnictwo Politechniki Gdańskiej, 2011 2. R. Jankowski, I. Lubowiecka, W. Witkowski: Podstawy Programowania w języku MATLAB. Wyd. PG Gdańsk 2003. 3. B. Mrozek, Z. Mrozek: MATLAB i Simulink. Poradnik użytkownika, Wyd. III, Helion 12/2010. 4. I. Lubowiecka, A. Ambroziak: MATLAB i jego środowisko, Wyd. PG Gdańsk 2016. 5. Materiały do laboratorium i ćwiczeń umieszczone na enauczanie.
Supplementary literature	1. Ryszard Klempka Bogusław Świątek Aldona Garbacz-Klempka: Programowanie, Algorytmy Numeryczne i Modelowanie w Matlabie, Wydawnictwa AGH, 2017
eResources addresses	

Example issues/ example questions/ tasks being completed	1. What do you understand by the term "algorithm" in relation to programming? List and describe what an algorithm includes and list the types of algorithms. 2. What do you understand by the term "TASK SPECIFICATION" in relation to programming? What steps can be listed in this process? 3. Describe the principle of operation of control statements, 'for' and 'while' loops? 4. Briefly describe the commands: expand, collect, and simplify. 5. Briefly describe the commands: input, fprintf, save, load. 6. Briefly describe the commands: subs, eval, double. 7. What are 'functions' in MATLAB? Describe their principle of operation. 8. List and describe the requirements for *.M file naming. 9. Write an algorithm for calculating the roots of a quadratic trinomial with the equation Ax2 + Bx + C = 0. 10. List and describe the basic control statements in MATLAB. 11. What do you understand by the term interpolation? 12. Describe the three basic Newton polynomial interpolations (depending on the degree of the polynomial). 13. What do you understand by the term approximation? 14. What do you understand by the term extrapolation? 15. Describe the differences between approximation and interpolation. 16. List and describe the basic interpolation methods (minimum 5). 17. List and describe the criteria used to assess the quality of approximations (minimum 4). 18. List and describe the types of approximations depending on the method of estimating approximation errors. 19. Describe the terms variance and standard deviation. 20. Describe the terms correlation coefficient and coefficient of determination. 21. What is standardization of the integration interval? 22. List and briefly describe the most commonly used numerical integration methods (minimum 4). 23. Describe the numerical integration methods: Newton-Cotes and the iterative Romberg algorithm, and indicate the difference between them. 24. Describe the numerical integration methods: Gaussian and Monte Carlo, and indicate the difference between them. 25. Describe interpolation approximation and uniform approximation, and indicate the difference between them. 26. Describe interpolation approximation and mean square approximation, and indicate the difference between them. 27. What do you understand by the terms covariance and correlation? 28. Describe the differences between the trapezoidal rule, Simpson's rule of one-thirds, and Simpson's rule of three-eighths. 29. What do you mean by "script" in MATLAB programming? 30. What do you mean by "function" in MATLAB programming?
Practical activites within the subject	Not applicable

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