GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00052287		
Field of study	Mathematics		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	Specialty subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Divison of Dynamical Systems -> Institute of Applied Mathematics -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Sergey Kryzhevich	
	Teachers	dr hab. Sergey Kryzhevich	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	0.0	0.0	30.0	60

E-learning hours included: 0.0

eNauczanie source address: https://enauczanie.pg.edu.pl/2025/course/edit.php?id=5221

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	60	5.0	35.0	100

Subject objectives

Introduction to basic tools and methods related to the theory of systems of nonlinear ordinary differential equations.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U07] at an advanced level and covering modern mathematics, applies and presents in speech and in writing the content and methods of a selected branch of mathematics	The student is able to solve autonomous linear systems and some nonlinear integrable systems.	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools
[K7_K02] formulates questions to deepen own understanding of a given topic or find missing elements of reasoning, understands the need to clearly present selected achievements of higher mathematics to laymen.	The student knows and is able to apply basic facts from stability theory and some numerical methods for solving nonlinear systems.	[SK3] Assessment of ability to organize work [SK4] Assessment of communication skills, including language correctness [SK5] Assessment of ability to solve problems that arise in practice
[K7_W01] has enhanced knowledge of basic branches of mathematics,demonstrates knowledge theorem and hypotheses, has understanding of the role and importance of mathematical reasoning structure.	The student is able to apply basic methods of linear algebra, mathematical analysis, functional analysis and other mathematical disciplines to solve systems of nonlinear ordinary differential equations or to carry them out for qualitative analysis.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation

<table>
<tr><td>Subject contents</td><td>Course content – lecture

1) General properties of nonlinear systems. Existence and uniqueness of solutions.
2) Homogeneous and inhomogeneous linear systems.
3) Fundamental matrices, Wronski determinants.
4) Systems with constant coefficients. Matrix exponents.
5) Euler's method.
6) Inhomogeneous systems and methods for solving them.
7) Dependence on initial conditions and parameters.
8) Stability.
9) Lyapunov functions.
10) Types of fixed points in the plane.

Course content – seminar
The program of seminarium is similar.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Knowledge of subjects: Algebra, Analysis, Ordinary Differential Equations.</td></tr>
<tr><td>Assessment methods and criteria</td><td><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Exercises</td><td>51.0%</td><td>50.0%</td></tr>
<tr><td>Exam</td><td>51.0%</td><td>50.0%</td></tr>
</table></td></tr>
<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>1.W. Żakowski, W. Leksiński, Matematyka, Część IV, Warszawa, 1995.

2. M. Gehwert, Z. Skoczylas, Równania różniczkowe zwyczajne: teoria, przykłady, zadania, Wrocław, 2001.</td></tr>
<tr><td>Supplementary literature</td><td>1. R.S. Guter, A.N. Janpolski, Równania różniczkowe, PWN, Warszawa, 1980.

2. W.I. Smirnow, Matematyka Wyższa, Tom II, PWN, Warszawa, 1966.</td></tr>
<tr><td>eResources addresses</td><td>Basic
https://caiomp-zchdn7o2dcaci7ei4p8lnc.vpn.pg.edu.pl/2025/course/view.php?id=5221 -</td></tr>
</table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>Students complete test works. Theoretical knowledge acquired in lectures and seminars is assessed in an exam.
Example questions.
1) State and prove the properties of the matrix exponent.
2) State and prove the fixed point stability theorem.
3) Determine the type of fixed points for a system of two equations.</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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