GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00052289		
Field of study	Mathematics		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2023/2024
Education level	second-cycle studies	Subject group	Optional subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	blended-learning
Year of study	2	Language of instruction	Polish
Semester of study	3	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Zakład Układów Dynamicznych -> Instytut Matematyki Stosowanej -> Faculty of Applied Physics and Mathematics		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Tomasz Szarek	
	Teachers	prof. dr hab. inż. Tomasz Szarek	

Lesson types and methods of instruction

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: 30.0

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

The aim of the lecture is to familiarize students with the basic concepts and facts in the field of dynamical systems and the theory of chaos.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K7_K04	The student understands the importance of fractal geometry and the theory of dynamical systems.	[SK4] Assessment of communication skills, including language correctness
K7_U09	The student knows the concepts of dynamical systems and fractal geometry.	[SU1] Assessment of task fulfilment
K7_W03	The student knows the Mountain Pass Theorem, the Generalized Ekeland Variational Principle, Sharkovski's Theorem, Kolmogorov's Theorem.	[SW1] Assessment of factual knowledge

Subject contents

Examples of fractals. Dimensions: fractal dimension, Hausdorff's dimension and topological dimension. The Barnsley and Hutchinson theory. Feigenbaum's bifurcation. Sharkovski's theorem. Hamiltonian systems. The mountain pass theorem. Generalized variational Ekeland principle. Kolmogorov's theorem.

Prerequisites and co-requisites

Mathematical analysis. Ordinary differential equations. Topology.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Test	50.0%	50.0%
Multimedia presentation	100.0%	50.0%

Recommended reading

Basic literature	1. Jacek Kudrewicz, Fractals and chaos, WNT, Warsaw, 2007 (in Polish) 2. Jean Mawhin, Michell Willem, Critical Points Theory and Hamiltonian Systems, Springer-Verlag, 1989.
Supplementary literature	H.-O. Peitgen, H. Jürgens, D. Saupe, Chaos and Fractals. New Frontiers of Science, Springer, 2004

	eResources addresses	Podstawowe https://enauczanie.pg.edu.pl/moodle/course/view.php?id=33196 - Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	1. Please provide the definition of a discrete dynamic system/a continuous dynamical system.2. What is an attractor? Please give examples of strange attractors.3. Please calculate the fractal dimension, Hausdorff's dimension and the topological dimension of given fractals.4. Please list the features of fractals.5. What is the Hamiltonian system?6. Please formulate the Mountain Pass Theorem and give its geometric interpretation.7. What is Sharkovski's theorem about?	
Work placement	Not applicable	