

## 表 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 Dyna Mathematics	stytut Matematyki Stosowanej -> Faculty of Applied Physics and						
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	Lesson type	Lecture	Tutorial	Laboratory	Project Seminar		Seminar	SUM
of instruction	Number of study hours	30.0	0.0	0.0	0.0	) 30.0		60
	E-learning hours inclu	uded: 30.0	•				•	
Learning activity and number of study hours	Learning activity	Participation in classes includ	n didactic ed in study	Participation i consultation h	cipation in ultation hours		udy	SUM
	Number of study hours	study 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	Subject passing criteria		Passing threshold		Percentage of the final grade			
and criteria	Test		50.0%		50.0%			
	Multimedia presentation		100.0%			50.0%		
Recommended reading	Basic literature	<ol> <li>Jacek Kudrewicz, Fractals and chaos, WN F, Warsaw, 2007 (in Polish)</li> <li>Jean Mawhin, Michell Willem, Critical Points Theory and Hamiltonian Systems, Springer-Verlag, 1989.</li> </ol>						
	Supplementary literature		HO. 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 d attractor? Please give examples of s dimension and the topological dimer Hamiltonian system?6. Please formu What is Sharkovski's theorem about	discrete dynamic system/a continuous dynamical system.2. What is an strange attractors.3. Please calculate the fractal dimension, Hausdorff's usion of given fractals.4. Please list the features of fractals.5. What is the late the Mountain Pass Theorem and give its geometric interpretation.7. ?
Work placement	Not applicable	