



Subject card

Subject name and code	Bifurcation theory in differential equations, PG_00062083						
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				
Mode of study	Full-time studies		Mode of delivery		at the university		
Year of study	1		Language of instruction		Polish		
Semester of study	1		ECTS credits		5.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Institute of Applied Mathematics -> Faculty of Applied Physics and Mathematics -> Wydziały Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Robert Krawczyk				
	Teachers		dr inż. Robert Krawczyk				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	0.0	0.0	0.0	60
	E-learning hours included: 0.0						
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		60.0	125
Subject objectives	The aim of the course is to familiarize students with the concept of the Brouwer degree, its use in bifurcation theory, and to show students basic 1 and 2 dimensional bifurcations in differential equations.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_U05] recognize topological structures in mathematical objects occurring, for example, in geometry or mathematical analysis; uses the basic topological properties of sets, functions and transformations, uses the language and methods of functional analysis		The student knows how to use the Brouwer degree to find bifurcation points		[SU2] Assessment of ability to analyse information		
	[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 can construct a method to calculate the degree of mappings that are not generic but are admissible.		[SU3] Assessment of ability to use knowledge gained from the subject		
	[K7_W02] has enhanced knowledge of a selected branch of mathematics,theoretical or applied, knows classical definitions and theorems and their proofs and connections with other fields,understands problems being examined		The student is able to calculate the Brouwer degree for maps that are generic		[SW1] Assessment of factual knowledge		
	[K7_U03] uses differential and integral calculus, elements of complex analysis, algebraic methods, applies them in typical practical		The student is able to find bifurcation points in differential equations and describe their type.		[SU4] Assessment of ability to use methods and tools		
Subject contents	Brouwer's degree, Bifurcation theory. Qualitative theory of solving differential equations. The Hartman-Grobman theorem.						
Prerequisites and co-requisites	The student knows methods of solving basic differential equations. Remembers what the maximum range of existence of a solution is. Knows what critical points of mappings are.						

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	activity	50.0%	20.0%
	the exam	50.0%	80.0%
Recommended reading	Basic literature	J. Hale and H. Kocak, Dynamics and Bifurcations, Springer-Verlag, 1991, L. Perko, Differential Equations and Dynamical Systems, Springer-Verlag, 2001.	
	Supplementary literature	E. Zehnder, Lectures on Dynamical Systems, EMS Textbooks in Mathematics, 2010.	
	eResources addresses	Basic https://enauczanie.pg.edu.pl/moodle/course/view.php?id=33886 -	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		

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