



Subject card

Subject name and code	Bifurcation theory in differential equations, PG_00062083						
Field of study	Mathematics						
Date of commencement of studies	October 2026	Academic year of realisation of subject			2026/2027		
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	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 -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Robert Krawczyk				
	Teachers		dr inż. Robert Krawczyk				
Lesson types	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_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_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_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		
	[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		
Subject contents	Course content – lecture 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
	the exam	50.0%	80.0%
	activity	50.0%	20.0%
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://enauczenie.pg.edu.pl/moodle/course/view.php?id=33886 -	
Example issues/ example questions/ tasks being completed			
Practical activities within the subject	Not applicable		

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