



Subject card

Subject name and code	Bifurcation theory in differential equations, PG_00062083						
Field of study	Mathematics						
Date of commencement of studies	October 2023	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			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	Instytut Matematyki Stosowanej -> Faculty of Applied Physics and Mathematics						
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		0.0		0.0	60
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_U06] Has the ability to recognize topological structures in mathematical objects occurring, for example, in geometry or mathematical analysis; is able to use the basic topological properties of sets, functions and transformations, uses the language and methods of functional analysis in the problems of mathematical analysis and its applications, in particular uses the properties of classical Banach and Hilbert spaces.	The student knows how to use the Brouwer degree to find bifurcation points	[SU1] Assessment of task fulfilment
	[K7_U04] Is familiar with the methods of solving classical ordinary and partial differential equations, is able to apply them in typical practical problems.	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 good understanding of the role and importance of mathematical reasoning structure.	The student is able to construct a degree calculation for mappings that are not generic but are admissible.	[SW3] Assessment of knowledge contained in written work and projects
	[K7_W05] Has enhanced knowledge of a selected branch of mathematics: knows most classical definitions and theorems and their proofs, Understands problems being examined, Knows relations between problems from particular field with other branches of mathematics, theoretical and applied	The student is able to calculate the Brouwer degree for generic mappings.	[SW2] Assessment of knowledge contained in presentation
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	Podstawowe https://enauczenie.pg.edu.pl/moodle/course/view.php?id=33886 - Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		