Subject card

Subject name and code	Bifurcation in the equations originating from the elasticity theory, PG_00021018					
Field of study	Mathematics					
Date of commencement of studies	October 2026		Academic year of realisation of subject		2028/2029	
Education level	first-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	3		Language of instruction		Polish	
Semester of study	6		ECTS credits		4.0	
Learning profile	general academic profile		Assessment form		assessment	
Conducting unit	Divison of Dynamical Systems -> Institute of Applied Mathematics -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology					
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. Joanna Janczewska			
	Teachers					

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	35.0	100

Subject objectives	Applications of mathematics in the theory of elasticity.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	K6_K01	A student is able to search for information in literature, also in English, on the theory of bifurcation and its applications in mathematics, mechanics, and biology.	[SK3] Assessment of ability to organize work
	K6_U09	A student is able to interpret the phenomenon of subcritical and postcritical bifurcation in tested models.	[SU4] Assessment of ability to use methods and tools
	K6_U06	A student knows how to apply knowledge from mathematical analysis and ordinary differential equations to study a model of deformations of a rod.	[SU3] Assessment of ability to use knowledge gained from the subject
	K6_K04	A student knows the equations of von Karman type for an elastic beam (4th order ODEs) and an elastic rectangular plate and an elastic circular plate (4th order PDEs).	[SK2] Assessment of progress of work
	K6_U05	A student knows the notion of a bifurcation point and a branching point. A student can explain the phenomenon of subcritical and postcritical bifurcation. A student can give necessary conditions for bifurcation.	[SU1] Assessment of task fulfilment

Subject contents	Course content – lecture The Kármán equations for an elastic beam (KE1). The Kármán equations for an elastic rectangular plate (KE2). The Kármán equations for an elastic circular plate (KE3). Boundary conditions. The Kármán equations (KE1) - (KE3) as an operator equation in Banach spaces. The linearization. The definition of a bifurcation point and a branching point. Necessary conditions for the existence of bifurcation. The Crandall-Rabinowitz theorem. Bifurcation in the Kármán equations (KE1) - (KE3).

Prerequisites and co-requisites	Ordinary differential equations. Partial differential equations.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	a multimedia presentation	100.0%	50.0%
	excercises for independent work	50.0%	50.0%

Recommended reading	Basic literature	1. F. Bloom, D. Coffin, Handbook of Thin Plate Buckling and Postbuckling, Chapman and Hall/CRC, 2001. 2. A. Borisovich, J. Dymkowska, Elementy Analizy Funkcjonalnej z Zastosowaniem w Mechanice Ciał Sprężystych [Functional Analysis with Applications in Elastic Mechanics], Politechnika Gdańska, Wydział Inżynierii Lądowej i Środowiska, skrypt dla słuchaczy Środowiskowego Studium Doktoranckiego Inżynierii Lądowej i Architektury Politechniki Gdańskiej, 2003 (in Polish).
	Supplementary literature	1. Z. Kączkowski, Płyty. [Plates.] Obliczenia statyczne, Arkady, Warszawa, 1968 (in Polish).
	eResources addresses	

Example issues/ example questions/ tasks being completed	• Derive the equation of von Karman type for an elastic beam. • Write von Karman equations for a circular/rectangular plate. • Formulate the definition of a bifurcation and a branching point. • Discuss the assumptions of the Crandall-Rabinowitz theorem. • Give a necessary condition on bifurcation.
Practical activites within the subject	Not applicable

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