



## Subject card

Subject name and code	Research project III, PG_00061296						
Field of study	Mathematics						
Date of commencement of studies	October 2023		Academic year of realisation of subject		2024/2025		
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	2		Language of instruction		Polish		
Semester of study	3		ECTS credits		4.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Division of Dynamical Systems -> Institute of Applied Mathematics -> Faculty of Applied Physics and Mathematics						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. Joanna Janczewska				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	0.0	0.0	30.0	15.0	45
	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	45		5.0		50.0	100
Subject objectives	Student project carried out as part of the subject Research project aims to prepare students for future work in a research team and to teach them how to timely fulfill obligations arising from the established schedule. The subject Research project includes the implementation of both research projects, the topics of which are formulated by academic teachers, and application projects, the topics of which can be formulated by external clients (e.g.: companies, local government units, scientific or organizational units of GDAŃSK TECH from outside Faculty of Applied Physics and Mathematics).						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_U02] Has the ability to check the correctness of conclusions in constructing formal proofs, sees formal structures related to the basic areas of mathematics in mathematical issues and understands the importance of their properties.		A student is able to check the correctness of inferences in formal proof, summarize the obtained results in the context of the considered problem, prepare a research report.		[SU1] Assessment of task fulfilment [SU5] Assessment of ability to present the results of task		
	[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		A student is able to define the problem, pose a research hypothesis, and propose a method of verifying the hypothesis.		[SW3] Assessment of knowledge contained in written work and projects		
	[K7_K03] Can work as a team; understands the necessity of systematic work on all projects that are long-term in nature, understands and appreciates the importance of intellectual honesty in one's own activities and the activities of other people; behaves ethically.		A student can work in a team; is able to define the work schedule for the implementation of a research project by specifying stages - corresponding to the tasks leading to the implementation of the research hypothesis - along with control dates.		[SK1] Assessment of group work skills [SK3] Assessment of ability to organize work		

Subject contents	<ul style="list-style-type: none"><li>• Scientific research and implementation of research projects.</li><li>• Preparation of project documentation.</li><li>• Research reporting and writing scientific articles.</li><li>• Publication models. Open Access.</li><li>• Research project results presentations.</li></ul>		
Prerequisites and co-requisites	Basic knowledge of mathematical analysis, analytical geometry, linear algebra, measure theory, probability theory. Basics of programming in C++ or Python.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Schedule	100.0%	25.0%
	Poster (PL, ENG)	100.0%	25.0%
	Report (Research paper)	100.0%	25.0%
	Presentation	100.0%	25.0%
Recommended reading	Basic literature	A supervisor determines a textbook list for each research team.	
	Supplementary literature	A supervisor determines a list of supplementary textbooks for each research team.	
	eResources addresses	Adresy na platformie eNauczanie: Projekt badawczy III - Moodle ID: 41965 <a href="https://enauczenie.pg.edu.pl/moodle/course/view.php?id=41965">https://enauczenie.pg.edu.pl/moodle/course/view.php?id=41965</a>	
Example issues/ example questions/ tasks being completed	<b>Research project topics carried out by students:</b> <ol style="list-style-type: none"><li>1. Modeling and assessment of symmetry in patients after facial bone fractures.</li><li>2. Detection of nail plate diseases using artificial intelligence methods.</li><li>3. Studying the effectiveness of an investment strategy based on technical analysis indicators on the NASDAQ stock exchange.</li><li>4. Comparison of data formats in graph neural networks (GNNs) and their computational efficiency in the GNN libraries: PyTorch Geometry (PyG) and Deep Graph Library (DGL).</li><li>5. Analysis of dataset features for deep learning.</li><li>6. Virtual sculptor.</li><li>7. Procedural creation of weather and atmospheric effects in 3D scenes using CUDA (like snow, dust, water).</li><li>8. Markov chains in terms of stochastic dynamic systems.</li><li>9. Mutual visibility problems in graphs.</li><li>10. Neural networks based on the laws of physics in predicting the evolution of dynamic systems - applications in epidemiology.</li><li>11. Determining the probability of patients belonging to a risk group for the occurrence of cerebral aneurysm using artificial intelligence methods.</li><li>12. Dold sequences and their connections with periodic point theory and number theory.</li></ol>		
Work placement	Not applicable		

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