GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Research project II, PG_00061293		
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	2	ECTS credits	1.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Zakład Układów Dynamicznych -> Instytut Matematyki Stosowanej -> Faculty of Applied Physics and Mathematics		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. Joanna Janczewska	
	Teachers	prof. dr hab. Joanna Janczewska	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	0.0	0.0	0.0	15.0	0.0	15

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	15	2.0	8.0	25

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_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
[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_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

Subject contents

- Presentations of research and application project topics that can be implemented by students as part of the course.
- Presentation of current issues in the field of cybersecurity.
- Group communication.
- Scientific research and conducting research projects.
- Copyrights.
- A systematic review of the scientific literature.
- Project documentation.
- How to plan a project well so that someone wants to finance it.
- Research reporting and scientific articles.
- Ways to prepare a presentation.

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%	33.33%
Report	100.0%	33.34%
Poster (PL, ENG)	100.0%	33.33%

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: Zespołowe projekty badawcze - Moodle ID: 38454 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=38454

Example issues/ example questions/ tasks being completed

Examples of research project topics proposed by academic teachers:

1. Numerical analysis of a system of ordinary differential equations modeling a food chain composed of three links with parameters in the environment of chaotic dynamics.
2. Morse functions as a tool for studying manifolds.
3. Existence and multiplicity of solutions to certain anisotropic problems.
4. Markov chains in terms of stochastic dynamic systems.
5. Modeling X-ray propagation using directed Gaussian beams.
6. Machine learning optimization.
7. Mutual visibility problems in graphs.
8. Design of an environment supporting the work of teachers and students in the subject of *Algorithms and Data Structures.*
9. Solutions of Hamilton's equations on a torus and complex projective space.
10. Neural networks based on the laws of physics in predicting the evolution of dynamic systems - applications in epidemiology.
11. Properties of attractors of various one-dimensional dynamic systems.
12. Ranges of parameters corresponding to chaos in models described by S-unimodal projections.
13. Application of critical point theory to study solutions of second-order Hamiltonian systems.

Work placement

Not applicable