GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Introduction to modeling physical phenomena, PG_00051067		
Field of study	Technical Physics		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2024/2025
Education level	first-cycle studies	Subject group	Obligatory subject group in the field of study 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	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Instytut Fizyki i Informatyki Stosowanej -> Faculty of Applied Physics and Mathematics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Ewa Erdmann	
	Teachers	dr inż. Ewa Erdmann	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	15.0	15.0	0.0	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	2.0	28.0	75

Subject objectives

The goal is to teach the student programming with the use of scientific libraries implemented for the selected programming language; to implement the mathematical model of the selected physical phenomenon in the form of a desktop application; to creation of documentation containing specification of requirements and system design.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W05] Has knowledge of programming methodology and techniques, and the use of selected IT tools in physics and technology.	The student has a basic knowledge of the methodology and techniques of programming in the selected language and scientific libraries that allow solving various problems.	[SW1] Assessment of factual knowledge
[K6_U02] Can analyze and solve simple scientific and technical problems, based on possessed knowledge, using analytical, numerical, simulation and experimental methods.	The student is able to analyze and solve simple scientific and technical problems through the implementation of mathematical models in the form of computer simulation and the analysis of the obtained results.	[SU1] Assessment of task fulfilment
[K6_K05] Can present own work results, transfer information in a commonly understandable manner, communicate and self-evaluate, as well as constructively evaluate the effects of other persons' work.	The student is able to present the effects of his work by regularly presenting the progress of the project and undertakes a polemic regarding the adopted decisions and solutions.	[SK2] Assessment of progress of work

<table>
<tr><td>Subject contents</td><td>Lecture topics:

Real objects versus physical and mathematical models. Interpreted vs compiled languages. Basic elements of Python syntax: complex built-in types, function definition, description of file operations, error handling. External libraries: numpy, scipy, matplotlib. Project documentation. Examples of projects modeling physical phenomena. Limitations of the possibilities of simulating physical phenomena

Computer labs:

In the computer laboratory, the content presented during the lecture is implemented into practice in the form of solving short programming problems.

Project:

Writing clear project documentation in line with software development standards. Implementation of the selected model / physical phenomenon.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Knowledge of the subject Procedural programming languages (PG_00051066)</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Written exam testing the lecture knowledge</td><td>50.0%</td><td>40.0%</td></tr>
<tr><td>Solution of the lab problems</td><td>50.0%</td><td>30.0%</td></tr>
<tr><td>Project implementation and presentation</td><td>50.0%</td><td>30.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>A. B. Downey, J. Elkner, C. Meyers, “Think Python. How to Think Like a Computer Scientist" http://greenteapress.com/thinkpython2/thinkpython2.pdf

Richard P. Feynman „The Feynman Lectures on Physics”</td></tr>
<tr><td>Supplementary literature</td><td>T.R. Padmanabhan "Programming with Python"</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
</table>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>Lecture:

1. Explain the difference between an interpreted and a compiled programming language. What are the benefits of writing programs using an interpreted language?
2. What does it mean that a built-in type is "mutable"? Give an example of a mutable data type in Python.
3. Give examples and describe the operations allowed on the list data type.
4. What is the def keyword for? Describe the syntax and rules for its use.
Computer labs:
1. Write a program that finds the least common multiple of any two natural numbers.
2. Write a program using a function that will calculate the total kinetic energy of the set of three particles with values of masses m_i and velocities V_i given as arguments to the function. Check how this energy will change when the velocity of one of the particles increases 10 times compared to the initial velocity.</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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