GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Monte Carlo Methods, PG_00059534		
Field of study	Technical Physics		
Date of commencement of studies	February 2024	Academic year of realisation of subject	2024/2025
Education level	second-cycle studies	Subject group	
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	English
Semester of study	2	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Zakład Metod Obliczeniowych Fizyki Chemicznej -> Instytut Fizyki i Informatyki Stosowanej -> Faculty of Applied Physics and Mathematics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Jan Franz	
	Teachers	dr hab. Jan Franz	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	0.0	0.0	0.0	30

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	30	0.0	0.0	30

Subject objectives

This course will introduce the foundations of Monte Carlo simulation methods. Basic technique and algorithms will be described. It will be shown how Monte Carlo methods can be used to simulate the transport of energetic particles in condensed matter. In addition Quantum Monte Carlo methods will be discussed.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W03] Has general knowledge of current development paths and discoveries in the scope of physics and related fields of science and technology.	The student has in-depth knowledge about Monte Carlo methods to simulate the transport of energetic particles in condensed matter.	[SW1] Assessment of factual knowledge
[K7_W02] Has enhanced, theoretically-founded, detailed knowledge of selected field of physics, and sufficient knowledge of related fields of science or technology.	The student has extended knowledge in the field of Monte Carlo method.	[SW1] Assessment of factual knowledge

Subject contents

1. Random Numbers
2. Probability and Statistics
3. Monte Carlo Strategies
4. Monte Carlo Simulation of Transport
5. Quantum Monte Carlo Methods

Prerequisites and co-requisites

Knowledge of the basics of classical mechanics and quantum mechanics.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
quizzes	50.0%	50.0%
homework	50.0%	50.0%

Recommended reading	Basic literature	1. W. Krauth, Statistical Mechanics: Algorithms and Computations, Oxford University Press, Oxford (2006) 2. K. Binder, D. W. Heermann, Monte Carlo Simulation in Statistical Physics (sixth edition), Springer Nature, Cham, Switzerland AG (2019) 3. M. Dapor, Transport of Energetic Electrons in Solids: Computer Simulation with Applications to Materials Analysis and Characterization (third edition), Springer Tracts in Modern Physics 271, Springer Nature, Cham, Switzerland AG (2020) 4. I. H. Hutchinson, A Student's Guide to Numerical Methods, Cambridge University Press, Cambridge (2015)
	Supplementary literature	1. O. N. Vassiliev, Monte Carlo Methods for Radiation Transport, Springer Nature, Cham, Switzerland (2017) 2. J. Seco, F. Verhaegen (editors), Monte Carlo Techniques in Radiation Therapy, CRC Press, Boca Raton, FL (2016)
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	What is the relationship between mean free path length and cross section?	
Work placement	Not applicable	