



Subject card

Subject name and code	Monte Carlo Methods, PG_00059534						
Field of study	Technical Physics						
Date of commencement of studies	February 2023	Academic year of realisation of subject			2023/2024		
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 Zajęcia będą prowadzone w języku angielskim.		
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_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		
[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			
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		
	homework		50.0%		50.0%		
	quizzes		50.0%		50.0%		

Recommended reading	Basic literature	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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	<p>Adresy na platformie eNauczanie:</p> <p>Monte Carlo Methods - 2023/24 - Moodle ID: 30987 https://enauzanie.pg.edu.pl/moodle/course/view.php?id=30987</p>
Example issues/ example questions/ tasks being completed	What is the relationship between mean free path length and cross section?	
Work placement	Not applicable	