

**DOCTORAL SCHOOL OF WROCLAW UNIVERSITY OF SCIENCE AND
TECHNOLOGY**

SUPERVISOR DECLARING/CONDUCTING COURSE: dr hab. inż. Krzysztof Burnecki,
profesor uczelni

DEPARTMENT: FACULTY OF PURE AND APPLIED MATHEMATICS

SCIENTIFIC DISCIPLINE: MATHEMATICS

COURSE CARD

Course name in Polish: Metody Monte Carlo w modelowaniu matematycznym

Course name in English: Monte Carlo methods in mathematical modelling

Course language: polish

The course is intended for all PhD students: YES / NO (interdisciplinary course in the field of several disciplines: mathematics, computer engineering and telecommunication, electronics and electrical engineering)

~~1) BASIC COURSE~~

2) SPECIALIST COURSE

~~3) SEMINAR~~

~~4) HUMANISTIC COURSE~~

~~5) LANGUAGE~~

~~6) RESEARCH SKILLS~~

Subject code: MAQ100257W

* delete as applicable

	Lecture	Foreign language course	Seminar	Mixed forms
Number of hours of organized classes in university (ZZU)	30			
Grading	Test			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic knowledge of probability theory and stochastic processes
2. Ability to self-supplement missing knowledge

COURSE OBJECTIVES

C1 Mastering knowledge on Monte Carlo methods and their applications in different areas of science and industry

C2 Development of skills related to the methodology and methodology of conducting of scientific research

PROGRAM CONTENTS

Form of classes – lecture (Lec)		Number of hours
Lec1	Monte Carlo methods. History. Mathematical foundations.	2

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Lec2	Simulation of discrete and continuous random variables.	4
Lec3	Simulation of random vectors.	3
Lec4	Simulation of classical stochastic processes.	4
Lec5	Estimation of the Monte Carlo method error. Confidence intervals.	2
Lec6	Variance reduction methods.	5
Lec7	Quasi-Monte Carlo methods.	2
Lec8	Markov chain Monte Carlo methods.	2
Lec9	Application of the Monte Carlo method to statistical hypothesis testing.	2
Lec10	Application of the Monte Carlo method to risk management in finance.	2
Lec11	Test	2
	Total hours	30

TEACHING TOOLS USED
N1. Lecture N2. Multimedia presentations N3. Open discussion N4. Consultations

ACHIEVED SUBJECT LEARNING OUTCOMES		
Type of learning outcome	Code of learning outcome	Assessment of learning outcome
Knowledge	P8S_WG	Has knowledge about Monte Carlo method basics and its applications.
Knowledge	P8S_WG	Knows advanced computational techniques that support a mathematician at work and is aware of their limitations.
Skills	P8S_UW	Has scientific and technological skills relevant to methods and methodology of conducting scientific research and critical evaluation of the results obtained
Social competence	P8S_KO	Is aware of the need for doctoral students and young researchers to participate in collective decision-making bodies in matters concerning the organisation of the educational process at a doctoral school, as well as to have direct contact with their superiors

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PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

- [1] S. Ross, Simulation, Academic Press, San Diego, 2013.
- [2] R. Korn, E. Korn, G. Kroisandt, Monte Carlo Methods and Models in Finance and Insurance, CRC Press, Boca Raton, 2010.
- [3] A. Barbu, S-Ch. Zhu, Monte Carlo Methods, Springer, Singapore, 2020.

SECONDARY LITERATURE:

- [1] Materiały prof. Martina Haugh: <http://www.columbia.edu/~mh2078/MonteCarlo.html>
- [2] P. Glasserman, Monte Carlo Methods in Financial Engineering, Springer, New York, 2003
- [3] R. Zieliński, Metody Monte Carlo, WNT, Warszawa 1970.

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

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