

WROCLAW UNIVERSITY OF TECHNOLOGY – PHD STUDIES

FACULTY OF PURE AND APPLIED MATHEMATICS
SUBJECT CARD
Course name in Polish: Metody Monte Carlo w Modelowaniu Matematycznym
Course name in English: Monte Carlo Methods in Mathematical Modelling
Course language: English
University-wide general course type: 1) basic course (mathematics, physics, chemistry, other) 2) humanity course 3) managerial skills 4) English language 5) other modern language Departmental course developing professional skills: 1) <u>specialized course</u> 2) interdisciplinary course 3) seminar (interdisciplinary, specialized, departmental)
Type of course (obligatory, <u>optional</u>)
Educational effects according to ZW 26/2017 regulations: P8S_WG, P8S_UW, P8S_KK, P8S_KR
Subject code: MAT1302

*delete as applicable

	Lecture
Number of hours of organized classes in University (ZZU)	30
Number of hours of total student workload (CNPS)	90
Form of crediting	Exam
Number of ECTS points	3
including number of ECTS points for practical (P) classes	
including number of ECTS points for direct teacher-student contact (BK) classes	2

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES
1. Knowledge of basic notions in probability theory and stochastic processes.. 2. Competence in reaching complementary areas of expertise.

SUBJECT OBJECTIVES		
<table border="1"> <tr> <td>C1</td> <td>Student will gain knowledge in the area of Monte Carlo methods and their applications to various fields of science</td> </tr> </table>	C1	Student will gain knowledge in the area of Monte Carlo methods and their applications to various fields of science
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SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:

PEK_W01 – Student has knowledge related to various aspects of Monte Carlo methods

PEK_W02 – Student knows advanced computational techniques supporting a mathematician's work. and understands their limitations

Relating to skills:

PEK_U01 – Student gains skills needed to perform his/her research.

PEK_U02 – Student is able to conduct his/her research.

Relating to social competences:

PEK_K01 – Student is aware of the role of cooperation, including an international cooperation.

PEK_K02 – Student is aware of the importance of the original research activity

PROGRAM CONTENTS

PROGRAM CONTENTS		
Form of classes – lecture		Number of hours
Lec 1	Monte Carlo methods. History. Theoretical foundations.	2
Lec 2	Simulation of discrete and continuous random variables.	2
Lec 3	Application of Monte Carlo method to multidimensional integration.	2
Lec 4	Quasi-Monte Carlo methods.	2
Lec5	Variance reduction methods.	6
Lec6	Markov chain Monte Carlo.	4
Lec7	Applications of Monte Carlo methods to statistical hypothesis testing.	4
Lec8	Application of Monte Carlo methods to risk management in finance and insurance.	6
Lec9	Application of Monte Carlo methods to energy usage optimization.	2
Total hours		30

TEACHING TOOLS USED

N1	lecture in the traditional form and with computer presentations
N2	project

EVALUATION OF ACHIEVED SUBJECT EDUCATIONAL EFFECTS

Evaluation: F – forming (partial) C – concluding	Educational effect number	Way of evaluating achievement of educational effects
F1	PEK_W01, PEK_W02	attendance of lectures

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F2	PEK_W01, PEK_W02, PEK_U01, PEK_U02, PEK_K01, PEK_K02	project
$C = 0.5 \cdot F1 + 0.5 \cdot F2$		

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] C. P. Robert; G. Casella, Monte Carlo Statistical Methods, Springer, New York, 2004.

SECONDARY LITERATURE:

- [1] P. Glasserman, Monte Carlo Methods in Financial Engineering, Springer, New York, 2003
- [2] R. Zieliński, Metody Monte Carlo, WNT, Warszawa 1970.

SUBJECT SUPERVISOR

(NAME AND SURNAME, E-MAIL ADDRESS)

dr hab. inż. Krzysztof Burnecki, krzysztof.burnecki@pwr.edu.pl

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**MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS
FOR SUBJECT
MONTE CARLO METHODS IN MATHEMATICAL MODELLING
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY
Doctoral studies at Faculty of Pure and Applied Mathematics**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)**	Subject objectives***	Programme content***	Teaching tool number***
(knowledge) PEK_W01	P8S_WG	C1	Lec1-9	N1, N2
PEK_W02	P8S_WG	C1	Lec1-9	N1, N2
(skills) PEK_U01	P8S_UW	C1	Lec1-9	N2
PEK_U02	P8S_UW	C1	Lec1-9	N2
(competences) PEK_K01	P8S_KK	C1	Lec1-9	N1, N2
PEK_K02	P8S_KR	C1	Lec1-9	N1, N2

** - enter symbols for main-field-of-study/specialization educational effects

*** - from table above