WROCŁAW 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: Polish

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) specialized course
2) interdisciplinary course
3) seminar (interdisciplinary, specialized, departmental)

Type of course (obligatory, optional)

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	
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 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 reaserch. **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		
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
F2	PEK_W01, PEK_W02, PEK_U01,	project

	PEK_U02, PEK_K01, PEK_K02	
C = 0.5*F1 + 0.5*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)
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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)	**P8S_KK**	C1	Lec1-9	N1, N2

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PEK_K01				
PEK_K02	**P8S_KR**	C1	Lec1-11	N1, N2

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