WROCŁAW UNIVERSITY OF TECHNOLOGY – PHD STUDIES

FACULTY OF PURE AND APPLIED MATHEMATICS ## SUBJECT CARD
Course name in Polish: Analiza Stochastyczna
Course name in English: Stochastic Analysis
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) <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: MAT1312

*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	The student will learn selected results on random Poisson measures and jump-type stochastic processes.
C2	The student will acquire the ability to use methods of stochastic processes to harmonic analysis.
C3	The student will acquire the skills of oral and written presentation of results of scientific work in a form accessible for non-specialists in the field related to the present issue

WROCŁAW UNIVERSITY OF TECHNOLOGY – PHD STUDIES

SUBJECT EDUCATIONAL EFFECTS
Relating to knowledge: PEK_W01 – Student has knowledge of methods of jump-type stochastic processes PEK_W02 – Student knows applications of stochastic processes to harmonic analysis **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	Construction of semigroups of Lévy processes	2
Lec 2	Lévy system	2
Lec 3	Random Poisson measures. Mecke-Palm formula	2
Lec 4	Moment formulas for Poisson-Skorokhod integrals	2
Lec5	Multiple interlaced Lévy systems	2
Lec6	Martingales defined by compensated Poisson integrals	2
Lec7	Lévy-Itô decomposition for Lévy processes	4
Lec8	Burkholder-Gundy inequality for martingales	2
Lec9	Burkholder's method	2
Lec10	Applications to Fourier multipliers	2
Lec11	Wagner-Platen expansions	2
Lec12	Elements of Malliavin calculus for jump processes	2
Lec13	Elements of Malliavin calculus for the Wiener processes	2
Lec14	Lévy system for Markov processes	2
Lec15	Selected applications to potential theory	2
	Total hours	30

TEACHING TOOLS USED	
N1	lecture
N2	consultations
N3	written assignments: problem solutions

EVALUATION OF ACHIEVED SUBJECT EDUCATIONAL EFFECTS		
Evaluation: F – forming (partial) C – concluding	Educational effect number	Way of evaluating achievement of educational effects

WROCŁAW UNIVERSITY OF TECHNOLOGY – PHD STUDIES

F1	PEK_W01, PEK_W02	participation in the course
F2	PEK_W01, PEK_W02, PEK_U01, PEK_U02, PEK_K01, PEK_K02	solutions of the problems
C = 0.5*F1 + 0.5*F2		

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE: [1] Ken-iti Sato, Lévy processes and infinitely divisible distributions. Cambridge Studies in Advanced Mathematics, 68, Cambridge University Press, Cambridge, 2013. [2] N. Privault, Stochastic analysis in discrete and continuous settings with normal martingales, Lecture Notes in Mathematics, 1982, Springer-Verlag, Berlin, 2009. [3] J.F.H. Kingman, Procesy Poissona, Wydawnictwo Naukowe PWN, 2002. **SECONDARY LITERATURE:** [1] K. Bogdan, T. Byczkowski, T. Kulczycki, M. Ryznar, Renming Song, Z. Vondraček, Potential analysis of stable processes and its extensions, Lecture Notes in Mathematics, 1980, Springer-Verlag, Berlin, 2009. [2] D. Revuz, M. Yor, Continuous martingales and Brownian motion, Grundlehren der Mathematischen Wissenschaften, 293, Springer-Verlag, Berlin, 1999.

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)
prof. dr hab. inż. Krzysztof Bogdan, krzysztof.bogdan@pwr.edu.pl

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS
FOR SUBJECT
STOCHASTIC ANALYSIS
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***

WROCŁAW UNIVERSITY OF TECHNOLOGY – PHD STUDIES

(knowledge) PEK_W01	P8S_WG	C1, C2	Lec1-15	N1, N2, N3
PEK_W02	P8S_WG	C1, C2	Lec1-15	N1, N2, N3
(skills) PEK_U01	P8S_UW	C2	Lec1-15	N2, N3
PEK_U02	P8S_UW	C2, C3	Lec1-15	N2, N3
(competences) PEK_K01	P8S_KK	C3	Lec1-15	N2, N3
PEK_K02	P8S_KR	C3	Lec1-15	N2, N3

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

*** - from table above