

WROCLAW UNIVERSITY OF TECHNOLOGY – PHD STUDIES

FACULTY OF PURE AND APPLIED MATHEMATICS
SUBJECT CARD
Course name in Polish: Nowoczesne techniki matematyczne, statystyczne i informatyczne
Course name in English: Modern Mathematical, Statistical and Numerical Techniques in Science
Course language: Polish
University-wide general course type: 1) <u>basic course</u> (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 (<u>obligatory</u> , optional)
Educational effects according to ZW 26/2017: P8S_WG
Subject code: MAT001684WL

*delete as applicable

	Lecture	Laboratory	Seminar
Number of hours of organized classes in University (ZZU)	30	30	
Number of hours of total student workload (CNPS)	90	90	
Form of crediting	Exam **	Exam / crediting with grade*	Oral presentation
Number of ECTS points			
including number of ECTS points for practical (P) classes			
including number of ECTS points for direct teacher-student contact (BK) classes			

*delete as applicable **In case of didactic courses also inspections and evaluation classes

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES
1. Completed courses in calculus and linear algebra

SUBJECT OBJECTIVES	
C1	Knowledge and skills on statistical and numerical data analysis
C2	Knowledge and skills on computing systems, software and services for data analysis

WROCLAW UNIVERSITY OF TECHNOLOGY – PHD STUDIES

SUBJECT EDUCATIONAL EFFECTS

Relating to knowledge:

PEK_W01 – Student knows basic mathematical, statistical and numerical tools of data analysis.

PEK_W02 – Can perform computing tasks in large computing systems.

Relating to skills:

PEK_U01 – Is able to choose and apply selected mathematical, statistical and numerical procedures for description and analysis of data.

PEK_U02 – Has skills in planning, automatization and performing computing tasks.

Relating to social competences:

PEK_K01 – Is able to search for information on data and methods.

PEK_K02 – Is aware of the role of large computing systems and services for carrying out research.

PROGRAM CONTENTS

Form of classes – lecture		Number of hours
Lec 1	Intruductory data analysis	2
Lec 2	Available data sets and sampling methods	2
Lec 3	Probabilistic models and selected tools of calculus	4
Lec 4	Basic statistical reasonings: confidence intervals and tests of significance	4
Lec 5	Monte Carlo Methods I	2
Lec 6	Midterm I	2
Lec 7	Linear regression and selected elements of linear algebra	4
Lec 8	Analysis of Variance	4
Lec 9	Analysis of categorical data	2
Lec 10	Monte Carlo Methods II	2
Lec 11	Midterm II	2
		30

Form of classes – laboratory		Number of hours
Lab 1	Basics of Linux	2
Lab 2	Writing scripts for automatic data processing	2
Lab 3	Selected symbolic and numerical calculations in Mathematica and Matlab	2
Lab 4	Tools to process results of calculations	
Lab5	Selected data processing protocols	2
Lab6	Managing outputs of calculations	2
Lab7	Services and and platforms for numerical experiments	2
Lab8	Selected statistical procedures and writing programs in R	2
Lab9	Monte Carlo computing in R	2
Lab10	Architecture of computer cluster and rules of sharing resources	2

WROCLAW UNIVERSITY OF TECHNOLOGY – PHD STUDIES

Lab11	Computing in clusters	2
Lab12	Architecture of computing grid and rules of sharing resources	2
Lab13	Performing data analysis in computing grid	2
Lab14	Auxilliary services for data analysis	2
Lab15	Oral examination	2
	Total hours	30

TEACHING TOOLS USED	
N1	Lecture: slides and traditional
N2	Computer Lab
N3	Homework and written tests

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_U01, PEK_K01	Homework and written tests
F2	PEK_W02, PEK_U02, PEK_K02	Performing tasks and preparing presentation for labs
$C=0.5 \cdot F1 + 0.5 \cdot F2$		

PRIMARY AND SECONDARY LITERATURE
<u>PRIMARY LITERATURE:</u> [1] J. Koronacki, J. Mielniczuk, Statystyka dla studentów kierunków technicznych i przyrodniczych, WNT, 2009 [2] M.Garrels, Introduction to Linux, TLDP, 2010 [3] G. Hager, G. Wellin, Introduction to High Performance Computing for Scientists and Engineers, Champan & Hall, 2010 [4] C. Newham, Learning the bash Shell: Unix Shell Programming, O'Reilly, 2005 <u>SECONDARY LITERATURE:</u> [5] D. Moore, G. McCabe, Introduction to the Practice of Statistics, ed. IV, Freeman, 2003 [6] N. Fieller, Basics of Matrix Algebra for Statistics with R [7] B. Wilkinson, Grid Computing: Techniques and Applications, Chapman & Hall, 2009 [8] J. E. Friedl, Mastering regular expression, O'Reilly, 2006

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)
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WROCLAW UNIVERSITY OF TECHNOLOGY – PHD STUDIES**CONNECTIONS OF EDUCATIONAL EFFECTS**

for the course: Modern Mathematical, Statistical and Numerical Techniques in Science

TO EDUCATIONAL EFFECTS FOR DOCTORAL STUDIES**(cf. ZW 26/2017) P8S_WG**

Subject educational effect	Corresponding educational effect of doctoral studies	Achieved educational effect***	Program contents***	Teching tool***
PEK_W01	P8S_WG	C1	Lec 1-Lec 11	N1, N3
PEK_W02	P8S_WG	C2	Lab 1-15	N2
PEK_U01	P8S_WG	C1	Lec 1-11	N1, N3
PEK_U02	P8S_WG	C2	Lab 1-15	N2
PEK_K01	P8S_WG	C1	Lec 1-11	N1, N3
PEK_K02	P8S_WG	C2	Lab 1-15	N2
*** cf. Table above				