

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

SUPERVISOR/TEAM/ DECLARING/CONDUCTING COURSE: Jan Magott, Rafał Zdunek,  
Olgierd Unold  
DEPARTMENT Faculty of Electronics

**COURSE CARD**

**Course name in Polish:** Inteligencja Obliczeniowa i jej zastosowania  
**Course name in English:** Computational Intelligence and Its Applications  
**Course language Polish**

**Specialized courses for PhD students receiving education in  
discipline\*:**

1) specialized course in discipline: Informatyka Techniczna i Telekomunikacja

**Subject code:** ITQ100137W

\* delete as applicable

	Lecture	Foreign language course	Seminar	Mixed forms
Number of hours of organized classes in university (ZZU)	30			
Grading	Exam	Exam	Oral presentation	Exam, inspection, evaluation classes

**PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES**

**COURSE OBJECTIVES**

- C1. Acquisition of knowledge of safety analysis using fault trees with fuzzy probabilities and event trees with fuzzy probabilities
- C2. To acquire the knowledge on fundamental feature extraction and dimensionality reduction methods
- C3. To acquire the knowledge on fundamental unsupervised learning methods in application to a blind source separation problem
- C4. acquisition of knowledge of basic evolutionary computation models
- C5. acquisition of fundamental knowledge in data mining
- C6. acquisition of fundamental knowledge in artificial immune systems
- C7. acquisition of knowledge of hybrid models and their applications

**PROGRAM CONTENTS**

<b>Form of classes – lecture (Lec)</b>		<b>Number of hours</b>
Lec1	Fundamentals of fuzzy sets theory and fuzzy arithmetic	4

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Lec2	Safety analysis in nuclear energy production using fault trees with fuzzy probabilities	2,5
Lec3	Analysis of serious air transportation incident using event trees with fuzzy probabilities	1,5
Lec4	Foundations of fuzzy inference, example from air transportation	2
Lec5	Introduction to the topics of feature extraction and dimensionality reduction – principle component analysis (PCA) and its applications	2
Lec 6	Feature extraction and dimensionality reduction – nonnegative matrix factorization and its applications	2
Lec 7	Tensorial feature extraction methods – models and algorithms	2
Lec 8	Tensorial feature extraction methods – applications in data analysis, clustering, and classification	2
Lec9	Unsupervised learning methods – blind source separation	2
Lec 10	Basic evolutionary computation models: GA, GP, EP, ES	2
Lec 11	Fundamentals of data mining	2
Lec 12	Artificial immune systems	2
Lec 13	Hybrid models and their applications	3
Lec 14	Written exam	1
	Total hours:	<b>30</b>

<b>Form of classes – foreign language course (Lng)</b>		Number of hours
Lng1		
Lng2		
Lng3		
..		
	Total hours:	

<b>Form of classes – seminar (Sem)</b>		Number of hours
Sem1		
Sem2		
Sem3		
...		
	Total hours:	

<b>Form of classes – mixed forms (mix)</b>		Number of hours
Mix1		
Mix2		
Mix3		
...		
	Total hours	

<b>TEACHING TOOLS USED</b>
N1. Traditional lectures using multimedia presentations N2. Consultation N3. Own work

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<b>ACHIEVED SUBJECT LEARNING OUTCOMES</b>		
Type of learning outcome	Code of learning outcome	Assessment of learning outcome
Knowledge	P8S_WG	Exam

<b>PRIMARY AND SECONDARY LITERATURE</b>
<p><b><u>PRIMARY LITERATURE:</u></b></p> <p>[1] J. Kacprzyk, Zbiory rozmyte w analizie systemowej, PWN, Warszawa, 1986. [2] A. Piegat, Modelowanie i sterowanie rozmyte, Akademicka Oficyna Wydawnicza EXIT, Warszawa, 1999. [3] D. Rutkowska, M. Piliński, L. Rutkowski, Sieci neuronowe, algorytmy genetyczne i systemy rozmyte, PWN, Warszawa-Łódź, 1997. [4] L. Rutkowski, Metody i techniki sztucznej inteligencji, PWN, Warszawa, Wydanie drugie zmienione, 2011 [5] J. Arabas, Wykłady z algorytmów ewolucyjnych, WNT, Warszawa, 2003 [6] D.E. Goldberg, Algorytmy genetyczne i ich zastosowania, WNT, Warszawa, 2003 [7] A. Cichocki, R. Zdunek, A.H. Phan, S.-I. Amari, Nonnegative Matrix and Tensor Factorizations: Applications to Exploratory Multi-way Data Analysis and Blind Source Separation, Wiley and Sons, 2009 [8] A. Cichocki, S.-I. Amari, Adaptive Blind Signal and Image processing, Wiley and Sons, 2002</p> <p><b><u>SECONDARY LITERATURE:</u></b></p> <p>[9] Computational Intelligence, An International Journal, Wiley Periodicals, Inc. [10] S. Sumathi, P. Surekha, Computational intelligence paradigms: theory and applications using MATLAB. Taylor&amp;Francis Group, 2010 [11] S. T. Wierzchóń, Metody reprezentacji i przetwarzania informacji niepewnej w ramach teorii Dempstera-Shafera, Instytut Podstaw Informatyki PAN, Warszawa 1996.</p>
<b>SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)</b>
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