FACULTY OF CIVIL ENGINEERING

SUBJECT CARD

Name in English:	**Sztuczna inteligencja w inżynierii lądowej**
Name in Polish:	**Artificial intelligence in civil engineering**
Main field of study (if applicable):	***Civil Engineering***
Specialization (if applicable):	**Civil Engineering**
Level and form of studies:	**~~1st /~~ 2nd level*, full-time ~~/ part-time~~***
Kind of subject:	**~~obligatory~~ / optional / ~~university-wide~~***
Subject code:	**CEB006063**
Group of courses:	**~~YES~~ / NO***

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	**15**		**15**		
Number of hours of total student workload (CNPS)	**30**		**60**		
Form of crediting	~~Examination~~ / crediting with grade *	Examination / crediting with grade *	~~Examination~~ / crediting with grade *	Examination / crediting with grade *	Examination / crediting with grade *
For group of courses mark (X) final course					
Number of ECTS points	**1**		**2**		
including number of ECTS points for practical (P) classes			**2,0**		
including number of ECTS points for direct teacher-student contact (BK) classes	**0,6**		**0,6**		

* delete as appropriate

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES
1. Basic knowledge in civil engineering – types of structures and processes
2. Skill in application of basic computer techniques

SUBJECT OBJECTIVES
C1. Learning the fundamental techniques used in computer tools with elements of artificial intelligence – applied in civil engineering
C2. Development of ability to design, computer implementation and testing of simple expert tools with elements of artificial intelligence

SUBJECT EDUCATIONAL EFFECTS	
Relating to knowledge:	
PEK_W01	The student knows and understands methods of knowledge acquisition and representation in expert systems
PEK_W02	The student knows methodology of design, computer implementation and testing of knowledge-based expert systems with elements of artificial intelligence
Relating to skills:	
PEK_U01	The student has skill to independent acquisition of knowledge in civil engineering
PEK_U02	The student has skill to design, computer implementation and testing of simple expert tools with elements of artificial intelligence, supporting decisions in civil engineering
Relating to social competences:	
PEK_K01	The student is able to unaided solving the problems and is also prepared to a team-work (laboratory reports, laboratory exercises)

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec1	Introduction to the lectures: aims, scope and plan of the course. Basic literature and examination rules. Artificial intelligence – what is this? Basic terms and definitions.	1
Lec2	Artificial intelligence in expert systems – classification, architecture, evolution, directions of development. Expert systems and range of their application in civil engineering.	2
Lec3	Technologies of knowledge acquisition and representation in computer systems. Knowledge bases and data bases. Expert functions in computer systems supporting management.	2
Lec4	Artificial neural networks – conception, architecture, training and testing techniques, applications.	2
Lec5	Fuzzy logic – fuzzy problems, linguistic variables, fuzzy reasoning procedures, testing, applications.	2
Lec6	Expert systems based on knowledge – design and implementation. Technology of hybrid networks in expert systems.	2
Lec7	Examples of artificial intelligence applications in civil engineering – expert tools supporting structure analysis and infrastructure management.	2
Lec8	Colloquium	2
	Total hours	**15**

Form of classes - class		**Number of hours**
Cl1		
...		
	Total hours	

Form of classes - laboratory		**Number of hours**
Lab1	General introduction: organization, crediting rules. Distribution of individual tasks, discussion of each task.	1
Lab2	Technologies of knowledge acquisition and computer representation – examples from selected fields of civil engineering.	2
Lab3	Technology of artificial neural networks creation – introduction to computer software.	2
Lab4	Practical design, training and testing of artificial neural networks.	2
Lab5	Individual task – conceptual design.	2
Lab6	Individual task – knowledge acquisition.	2

Lab7	Individual task – computer implementation and testing.	2
Lab8	Presentation of results and evaluation of the report.	2
	Total hours	**15**

Form of classes - project		**Number of hours**
Proj1		
…		
	Total hours	

Form of classes - seminar		**Number of hours**
Sem1		
…		
	Total hours	

TEACHING TOOLS USED
N1. Lecture: multimedia presentations of all parts of the course programme, presentation of computer software supporting bridge management.
N2. Laboratory: multimedia presentations, software presentations, data preparation, data input and processing by means of computer systems, analysis and discussion of the results.
N3. Individual consultations.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
P (lecture)	PEK_W01, PEK_W02	Colloquium
P (laboratory)	PEK_U01, PEK_U02, PEK_K01	Final laboratory report, active work in laboratory

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] 1. Russell S., Norvig P., Artificial Intelligence: A Modern Approach, Prentice Hall, 2009.
[2] Samarasinghe S., Neural Networks for Applied Sciences and Engineering: From Fundamentals Complex Pattern Recognition, Auerbach Publications – Taylor & Francis Group, 2006.
[3] Wang P. P., Ruan D., Kerre E. E., Fuzzy Logic: A Spectrum of Theoretical and Practical Issues, Springer, 2007.

SECONDARY LITERATURE:

[1] 1. Gurney K., An Introduction to Neural Networks, Taylor & Francis e-Library, 2005.
[2] Liebowitz J., The Handbook of Applied Expert Systems, CRC Press, 1999.
[3] Nguyen H. T., Prasad N. R., Walker C. L., Walker E. A., A First Course in Fuzzy and Neural Control, CHAPMAN & HALL/CRC, 2003.

SUBJECT SUPERVISOR (NAME AND SURNAME, DIVISION, E-MAIL ADDRESS)

prof. dr hab. inż. Jan Bień, Bridge and Railway Department, jan.bien@pwr.edu.pl
dr inż. Mieszko Kużawa, Bridge and Railway Department, mieszko.kuzawa@pwr.edu.pl

MEMBERS OF TEH EDUCATIONAL TEAM (NAME AND SURNAME, E-MAIL ADDRESS)

prof. dr hab. inż. Jan Bień, jan.bien@pwr.edu.pl
dr inż.Tomasz Kamiński, tomasz.kaminski@pwr.edu.pl
dr inż. Mieszko Kużawa, mieszko.kuzawa@pwr.edu.pl
PhD students of the Bridge and Railway Department

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Artificial intelligence in civil engineering
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY ***Civil Engineering***
AND SPECIALIZATION **Civil Engineering**

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	K2_W11, K2_W12, K2S_CEB_W22	C1, C2	Lec1 to Lec8	N1, N3
PEK_W02	K2_W12, K2S_CEB_W22	C1, C2, C3	Lec1 to Lec8	N1, N3
Skills				
PEK_U01	K2_U16, K2_U17, K2S_CEB_U23	C2, C3	Lec1 to Lec3, Lab1, Lab2, Lab5, Lab6	N1, N2, N3
PEK_U02	K2_U16, K2_U17, K2S_CEB_U23	C2, C3	Lec4 to Lec7, Lab1, Lab4 to Lab8	N1, N2, N3
Social competences				
PEK_K01	K2_K01, K2_K03	C3	Lab2 to Lab8	N2, N3

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