

Cracow University of Technology

Course syllabus

binding for the doctoral students of the CUT Doctoral School commencing their studies
in the academic year 2022/2023

Information on the course

Name of the course in Polish	Sieci Neuronowe i Algorytmy Genetyczne w Zagadnieniach Transportowych
Name of the course in English	Neural Networks and Genetic Algorithms in Transport
Number of the ECTS points	1
Language of instruction	Polish
Category of the course	Choosable
Field of education	Engineering and Technology
Discipline of education	Civil Engineering and Transport
Person responsible for the course Contact	CUT Prof Vitalii Naumov PhD Eng. vitalii.naumov@pk.edu.pl

Type of course, number of hours in the study programme curriculum

Semester	Credit type (G / NG)*	Lecture	Practical classes	Laboratory	Computer Lab	Project Class	Seminar
2, 3, 4, 5	G	7	0	0	8	0	0

*G – graded credit, NG – non-graded credit

Course objectives

Code	Objective description
Objective 1	Expanding knowledge in the field of optimization
Objective 2	Acquiring the ability to use artificial intelligence tools

Learning Outcomes

Code	Description of the learning outcome adjusted to the specific characteristics of the discipline	Learning outcome symbol in the CUT SD	Methods of verification
OUTCOMES RELATED TO KNOWLEDGE			
EUW1	A PhD student has knowledge of the application of artificial intelligence methods in transport issues	E_W02, E_W03	Final task
OUTCOMES RELATED TO SKILLS			
EUU1	A PhD student is able to formulate a problem in a form convenient for solving it with intelligent methods	E_U02	Laboratory exercise

EUU2	A PhD student can use specialized packages and libraries to create software applications that solve transport issues	E_U02	Laboratory exercise
OUTCOMES RELATED TO SOCIAL COMPETENCES			
EUK1	A PhD student is ready to critically evaluate the results of simulation of transport processes	E_K01	Discussion during classes

Course outline

No.	Contents	Learning outcomes for the course	No. of hours
LECTURE			
W1	Artificial neural networks: neuron models, network architecture, learning process, optimization of network architecture	EUW1, EUK1	2
W2	Genetic algorithms: mathematical foundations, chromosome coding methods, fitness function	EUW1, EUU1, EUU2	2
W3	Selection of the initial population, assessment and selection of chromosomes, reproduction with the use of genetic operators	EUW1, EUU1, EUU2, EUK1	3

COMPUTER LAB			
K1	Linear and nonlinear networks, unidirectional and recursive networks	EUU1, EUU2, EUK1	2
K2	Examples of applications of neural networks in the field of transport and logistics	EUU1, EUU2, EUK1	2
K3	The use of genetic algorithms to solve optimization problems in transport and logistics	EUU1, EUU2, EUK1	2
K4	Hybrid systems: a combination of neural networks and genetic algorithms	EUU1, EUU2, EUK1	2

The ECTS points statement

WORKING HOURS SETTLEMENT	
Type of activity	Average number of hours (45 min.) dedicated to the completion of an activity type
SCHEDULED CONTACT HOURS WITH AN ACADEMIC TEACHER	
Hours allotted in the syllabus	15
Consultations	1
Examination / course credit assignment	1
HOURS WITHOUT THE PARTICIPATION OF AN ACADEMIC TEACHER	
Independent study of the course contents	6
Preparation of a paper, report, project, presentation, discussion	7
ECTS POINTS STATEMENT	
Total number of hours	30
The ECTS points number	1

Preliminary requirements

No.	Requirements
1	Knowledge of the basics of higher mathematics
2	Knowledge of the basics of programming

Course credit assignment conditions / method of the final grade calculation

No.	Description
COURSE CREDIT ASSIGNMENT CONDITIONS	
1	80% attendance in class. Completion of a final task
METHOD OF THE FINAL GRADE CALCULATION	
Assessment of the final task, taking into account the attendance	

Additional information

Not specified

The course reading list

1	Kosiński, R., <i>Sztuczne Sieci Neuronowe</i> , 2014, WNT
2	Rutkowska, D., <i>Sieci Neuronowe, Algorytmy Genetyczne i Systemy Rozmyte</i> , 1999, PWN
3	Tadeusiewicz, R., <i>Odkrywanie Właściwości Sieci Neuronowych</i> , 2007, PAU
4	Himanen, V., <i>Neural Networks in Transport Applications</i> , 1998, Ashgate Publishing
5	Goldberg, D.E., <i>Algorytmy Genetyczne i Ich Zastosowania</i> , 2003, WNT