Wrocław University of Science and Technology
Doctoral School

COURSE CARD

1. Basic information

Course name in English:	Artificial Intelligence: Introduction and application in Engineering	
Course name in Polish:	Sztuczna Inteligencja: Wprowadzenie i zastosowania w inżynierii	
Number of hours:	30	
Type of course:	Elective course	
Form of course:	seminar	
Code of course:		
Course leader:	Dr inż. Marek Mysior	
Faculty of the course leader:	W10 Faculty of Mechanical Engineering	
Email address of the course leader:	marek.mysior@pwr.edu.pl	
Scientific discipline(s) assigned to the course (doctoral students representing the marked disciplines can participate in the course):	Architecture and urban planning	☒
	Automation, electronic, and electrical engineering	☒
	Information and communication technology	☒
	Biomedical engineering	☒
	Chemical engineering	☒
	Civil engineering and transport	☒
	Materials engineering	☒
	Mechanical engineering	☒
	Environmental engineering, mining, and energy	☒
	Mathematics	☒
	Chemical sciences	☒
	Physical sciences	☒
	Management and quality studies	☒

2. Objectives

C1. To gain basic knowledge related to artificial intelligence.
C2. To gain skills to determine problems possible to solve with AI in Ph.D. related work.
C3. To gain skills to program basic models with implemented artificial intelligence.
C4. To gain skills related to search information about AI methods, algorithms, and best practices.
C5. To gain up-to-date knowledge about achievements in Engineering with the usage of artificial intelligence

3. Content

Detailed information about the course content, including topics and form of classes.

No.	Topic	Number of hours	Form of classes
1	Introduction to Artificial Intelligence: Basic concepts, history of AI, trends, and direction of AI development. Ethics of AI.	2	lecture
2	Introduction to regression, classification, and clustering. Discussion about basic concepts and challenges of AI.	2	lecture
3	Presentation of current Integrated Developer Environments, AI platforms, and programming packages for implementation of AI algorithms.	2	lecture
4	Review of methods, models, and algorithms. Discussion about implementation and application.	2	lecture
5	Application of AI in Mechanical Engineering: Review of current state-of-the-art achievements in Mechanical Engineering based on literature review.	2	lecture
6	Application of neural network in Mechanical Engineering: Detailed case study.	2	lecture
7	Parallel Coding lecture: Input Data Preparation	2	lecture
8	Parallel Coding lecture: Regression Models	2	lecture
9	Parallel Coding lecture: Classification Models	2	lecture
10	Parallel Coding lecture: Simple Artificial Neural Network Models	2	lecture
11	Parallel Coding lecture: Convolutional Neural Network Models	2	seminar
12	PhD students presentation and discussion 1: Presentation of a possible application of AI in area related to the planned PhD thesis or Literature review of AI usage with respect to planned PhD reseach field	2	seminar
13	PhD students presentation and discussion 2: Presentation of a possible application of AI in area related to the planned PhD thesis or Literature review of AI usage with respect to planned PhD reseach field	2	seminar
14	PhD students presentation and discussion 3: Presentation of a possible application of AI in area related to the planned PhD thesis or Literature review of AI usage with respect to planned PhD reseach field	2	seminar
15	PhD students presentation and discussion 4: Presentation of a possible application of AI in area related to the planned PhD thesis or Literature review of AI usage with respect to planned PhD reseach field	2	seminar

4. Prerequisites

List of prerequisites relating to knowledge, skills and other competences for course participants.

1. Basic knowledge in:
   a) Information Technology
   b) Programming (Python 3.x)
   c) Mathematics and statistics
2. Pre-defined research topic of PhD
3. General knowledge in related field of Engineering at the second level of studies

5. Learning outcomes

List of learning outcomes at level 8 of the Polish Qualifications Framework assigned to the course (mark the learning outcomes in the last column).

Symbol	Learning outcome	
	KNOWLEDGE. Doctoral student knows and understands:	
SzD_W3	the main trends in the development of the scientific or artistic disciplines covered in the curricula;	☒
SzD_W4	research methodology;	☒
SzD_W5	the rules for the dissemination of scientific results, including in open access mode;	☐
SzD_W6	the fundamental dilemmas of modern civilization;	☐
SzD_W7	the legal and ethical conditions of scientific activity;	☐
SzD_W8	the economic and other relevant conditions of scientific activity;	☐
SzD_W9	basic principles of knowledge transfer to the economic and social spheres and commercialisation of results of scientific activity and know-how related to these results.	☐
	SKILLS. Doctoral student is able to:	
SzD_U2	use knowledge from different fields of science or art to creatively identify, formulate and innovatively solve complex problems or perform research tasks, in particular: - define the purpose and subject of scientific research, formulate a research hypothesis, - develop research methods, techniques and tools, and use them creatively, - draw conclusions on the basis of scientific research; critically analyse and evaluate the results of scientific research, expertise and other creative work and their contribution to knowledge development; transfer the results of scientific activities to the economic and social spheres;	☒
SzD_U3	communicate on specialised topics to the extent that they enable an active participation in the international scientific community;	☐
SzD_U4	disseminate research results, including in popular forms;	☐
SzD_U5	initiate debates and participate in a scientific discourse;	☒
SzD_U6	be able to speak a foreign language at B2 level of the Common European Framework of Reference for Languages to a level that enables them to participate in the international scientific and professional environment;	☐

SzD_U7	plan and implement an individual or collective research or creative activity, including in an international environment;	☐
SzD_U8	independently plan and act for one's own development and inspire and organize the development of others;	☐
SzD_U9	plan classes or groups of classes and implement them using modern methods and tools.	☐
	SOCIAL COMPETENCES. Doctoral student is ready to:	
SzD_K3	fulfilling the social obligations of researchers and creators, initiate public interest activities, thinking and acting in an entrepreneurial way;	☐
SzD_K4	maintaining and developing the ethos of research and creative environments, including: - carrying out scientific activities in an independent manner, - respecting the principle of public ownership of research results, taking into account the principles of intellectual property protection.	☒

6. Evaluation

Short description of the method(s) used to evaluate the learning outcomes assigned to the course, e.g., exam, test, report, presentation, etc.

Evaluation is based on PhD student's presentation during seminar meetings.

7. Teaching methods

Short description of the teaching methods used during the course, e.g., multimedia presentation, discussion, literature studies, developing written documents, own work, etc.

N1. Lecture
N2. Presentation
N3. Discussion
N4. Self work
N5. Parallel coding with teacher

8. Literature

List of primary and secondary literature used to prepare the course and including additional knowledge for participants, e.g., books, textbooks, research papers, standards, web pages, etc.

[1] I. Goodfellow, Y. Bengio, and A. Courville, Deep Learning. MIT Press, 2016.
[2] C. M. Bishop, Pattern Recognition and Machine Learning. Springer New York, 2016.
[3] A. Zhang, Z. C. Lipton, M. Li, and A. J. Smola, Dive into Deep Learning. 2020.

9. Other remarks

Additional remarks, comments, (e.g., language of the course)

Python programming language is a base of AI considerations.