SYLLABUS

Course description

Course code	Course	Sztuczna inteligencja
ME/O/I/ST/*B17*		Artificial Intelligence
Language of instruction		English
Academic year		2025/2026
field of study:		Mechanical Engineering
field of specialisation:		All
Educational level		first-cycle studies
Education profile		General academic
Mode of study		Full-time studies
Semester(s)		5
Affiliation with a group of classes		B . Group of obligatory course core subject
Course status		Obligatory

Types of classes, instruction hours, ECTS credits	Types of classes	Number of instruction hours	Number of ECTS credits
	Lecture	15[h]	2ECTS
	Classes	0[h]	
	Lab	15[h]	

Linkage of the course	with the education profile	Related to the conducted scientific activity in the discipline to which the field of study is assigned	2ECTS
	with qualifications	It is used to acquire engineering competences by the student	2 ECTS
	with science discipline	Mechanical engineering	2ECTS

Form of teaching	Traditional – classes organized at the University /classes conducted using distance learning methods and techniques
Prerequisites	knowledge of mathematics
Department	Faculty of Mechanical Engineering
Coordinator	dr hab. inż. Przemysław Motyl, prof. URad.
The website of the basic organizational unit	http://wm.uniwersytetradom.pl
E-mail address, phone number of the coordinator	p.motyl@urad.edu.pl

LEARNING OUTCOMES, CURRICULUM CONTENT, TEACHING CLASSES, VERIFICATION OF LEARNING OUTCOMES

Learning Objective:	The aim of the course is to introduce students of Mechanical Engineering to the fundamental concepts, methods, and tools of Artificial Intelligence (AI), and to develop practical skills in

	applying AI techniques in engineering design, diagnostics, and technical maintenance. The course emphasizes the use of AI in the context of machine condition monitoring, predictive maintenance, sensor data analysis, and technical inspections. Students will acquire competencies in the processing of mechanical data, implementation of machine learning algorithms, and evaluation of their performance and limitations in industrial applications.
Curriculum Content:	Lectures and exercises: The lecture part of the course introduces fundamental concepts, the historical development, and the classification of Artificial Intelligence (AI) methods, with particular emphasis on their application in mechanical engineering. Students will learn about supervised and unsupervised learning algorithms, including training, testing, and validation procedures. Key areas of application such as technical diagnostics, design optimization, and fault detection will be discussed. Attention will be given to sensor data analysis from machines and industrial systems, along with an introduction to computer vision techniques. The course also explores the use of AI in predictive maintenance, based on historical and real-time operational data. Finally, the lectures address the limitations of AI algorithms, their reliability, interpretability, and ethical considerations in the context of engineering applications. Laboratory: In the laboratory sessions, students will install and configure programming environments and become acquainted with Python and widely used machine learning libraries (e.g., scikit-learn, TensorFlow, PyTorch). They will implement and train basic machine learning models to solve classification and regression problems relevant to mechanical systems. Students will also construct and train neural networks to analyze signals such as vibration, temperature, and other operational data. Convolutional neural networks (CNNs) will be applied to technical image analysis, including surface defect detection and component wear identification. Sensor data will be analyzed to predict mechanical failures. The course concludes with a practical project, in which students design and implement an AI-based diagnostic or predictive system for a selected mechanical component or subsystem.
Didactic (educational) methods:	feeding methods (information lecture, lecture, reading), problem methods (problem lecture, conversational lecture), activating method
Course assessment type, the criteria for assessing the achieved learning outcomes, and the method of calculating the final grade:	The condition for passing the course is to achieve all the required learning outcomes specified for the course. This includes obtaining positive grades from laboratory reports, project implementation, and the final written or oral examination. Active participation in laboratory classes and completion of all assigned programming tasks and reports are mandatory. A minimum threshold of 50% of the total available points is required to pass the course. Additionally, students must demonstrate the ability to apply theoretical knowledge and AI techniques to solve practical engineering problems related to mechanical systems, diagnostics, and data analysis.

Learning outcomes for the course in relation to the field of study learning outcomes and the type of classes				Methods of verifying learning outcomes	
Learning outcome number	Description of the learning outcomes for the course (PEU) A student who has passed the course	Field of study learning outcome	Types of classes	Form of verification (credits)	Methods of testing and

	(**W**) knows and understands / (**U**) can / (**K**) is ready to:	(KEU)			assessment
W1	The student has structured knowledge of the basic methods and applications of artificial intelligence, including machine learning, image analysis, and data-driven diagnostics relevant to mechanical engineering.	K_WG14	Lecture	Credit with grade	Written test (evaluation test)
U1	The student is able to select and apply appropriate artificial intelligence methods and tools to solve practical engineering problems related to machine diagnostics and predictive maintenance.	K_UW12	Exercises Laboratories	Credit with grade	Written test, assessment of laboratory reports, observation during classes
U2	The student is able to plan and carry out AI-based experiments (e.g., training, testing, validation of models), interpret results and draw conclusions regarding their applicability to mechanical systems.	K_UW13	Exercises Laboratories	Credit with grade	Laboratory reports, practical performance during laboratory sessions, oral test
K1	The student is able to work effectively as a member of an engineering team, demonstrates responsibility and communication skills in collaborative development of AI-based solutions.	K_KK02	Exercises Laboratories	Credit (pass/fail or grade, depending on system)	Observation of teamwork, participation during exercises, verbal assessment

Literature and teaching aids
Primary literature: 1. Marcin Szeliga, Praktyczne uczenie maszynowe, Wydawnictwo Naukowe PWN, ISBN Ebooka: 978-83-012-0784-7, 2019 2. Aurélien Géron, Uczenie maszynowe z użyciem Scikit-Learn, Keras i TensorFlow. Wydanie III, Wydawnictwo Helion, 2023 Study aids: To support students' learning process, the following materials and tools are made available: • Lecture slides and detailed handouts • Sample problems with solutions for self-study • Access to laboratory manuals and experiment instructions

Student workload required to achieve the assumed learning outcomes – the balance of ECTS credits		
Attendance, participation	Student workload [h].	
	Student's self-study hours Classes without a teacher (ZBN**)**	Classes
Participation in lectures/classes/lab	X	15/0/15[h]
Preparation for lectures/classes/lab , Preparation for ... credit / exam	15/0/15 [h]	X
Total student workload Preparation for ... credit / exam	30[h]/ 1 ECTS	30 [h]/ 1 ECTS
ECTS points per subject	2 ECTS	

Additional information, comments

In the case of students with special needs, including disabilities, and chronic illnesses, the methods and forms of verification of learning outcomes specified above (in the syllabus) are adapted to the individual needs of these students, as appropriate.
Detailed rules and forms of support for students with special needs, including those with disabilities and chronically ill, during classes, credits, and exams are specified in: University Regulations (Regulamin Studiów Uniwersytetu Technologiczno-Humanistycznego w Radomiu), Study Regulations (Zasady Studiowania), and Procedure for Ensuring Accessibility of the Educational Process to Students with Special Needs, Including Those with Disabilities and Chronically ill (Procedura dotycząca zapewnienia dostępności procesu kształcenia studentom ze szczególnymi potrzebami, w tym: z niepełnosprawnością, przewlekle chorych).