SYLLABUS

Course description

Course code	Course	Diagnostyka techniczna		
ME/O/I/NST/B20		Technical diagnostics		
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	Part-time studies			
Semester(s)	6			
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	8 [h]	5 ECTS	
	Classes	[h]		
	Lab	24 [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	ECTS		
Linkage of the course – with qualifications	It is used to acquire engineering competences by the student	5 ECTS		
Linkage of the course – with science discipline	Mechanical engineering	5 ECTS		
Form of teaching	Traditional – classes organized at the University /classes conducted using distance learning methods and techniques			
Prerequisites	knowledge of mechanics (statics) and mathematics			
Department	Department of Automotive Vehicles			
Coordinator	Assoc Prof. Krzysztof Górski			
The website of the basic organizational unit	http://wm.uniwersytetradom.pl			
E-mail address, phone number of the coordinator	krzysztof.gorski@urad.edu.pl			

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

Learning Objective:	Upon completing the course, students will be able to explain the fundamental concepts and significance of technical diagnostics, identify and classify diagnostic methods, and interpret diagnostic measurement results. They will master

	non-destructive testing (NDT) techniques for assessing the technical condition of mechanical components and learn to evaluate the causes of failures and predict the lifespan of machine elements based on wear symptoms. Students will acquire the ability to select and operate diagnostic tools used in workshops and design simple systems for monitoring the technical condition of machines. Additionally, they will be able to conduct diagnostics of real mechanical systems based on actual operational data and case studies.
Curriculum Content:	**Lectures:** presentation of the course syllabus, assessment criteria, literature, and health and safety regulations. The Curriculum Content covers key areas of technical diagnostics, including an Introduction to Technical Diagnostics, focusing on its significance and applications in mechanical systems. It also includes measurement and data acquisition in diagnostics, exploring sensor technologies and data processing methods. Selection and separation of useful signals, as well as spatial, temporal, and spectral selection. Fourier and wavelet transform. Students will learn about non-destructive testing (NDT) Methods. The course also covers vibration and acoustic diagnostics, environmental aspects of machine maintenance, analyzing machine condition through vibration and noise signals. Additionally, Lubricant and Fluid Analysis in Diagnostics will teach methods for assessing wear and contamination in mechanical systems. The program further includes electrical system diagnostics, with a focus on on-board diagnostics (OBD) and fault detection techniques. Students will also study Failure Analysis and Life Cycle Prediction, learning to identify failure causes and estimate component lifespan. The curriculum introduces Diagnostic Equipment, covering modern testing instruments and software. **Laboratories:** cover the following topics: Visual methods in diagnostics – thermography. Amplitude-frequency analysis of machine vibrations. Assessment of the technical condition of hydraulic systems. On-board diagnostic systems. Examination of the wear of selected operating fluids in machines. Sensor diagnostics. Battery diagnostics. Environmental aspects in machine diagnostics. Diagnostics of machine working processes. Diagnostics of the onboard CAN network.
Didactic (educational) methods:	Didactic methods like lecture-based teaching, where the instructor delivers content to students, often using visual aids such as slides, diagrams, or videos.hands-on learning, case-based learning, collaborative work, and problem-based learning. These methods combine theoretical knowledge with practical experience, encourage critical thinking, and foster teamwork, allowing students to apply their learning to real-world scenarios and solve complex problems.
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 out comes specified for the course. In the case of the lecture, the grade is based on the result of a test. Laboratories are graded based on the average scores from the entry tasks and the acceptance of subsequent reports on the exercises performed by the instructor.

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 (**W**) knows and understands / (**U**) can / (**K**) is ready to:	Field of study learning outcome (KEU)	Types of classes	Form of verification (credits)	Methods of testing and assessment
W1	knows the basic techniques, methods and tools used in the technical diagnostics	K_WG10	lecture	written exam	Theoretical test

U1	can properly plan and perform tests, including measurements, interpret the obtained results, and correctly draw conclusions from them	K_UW06	laboratory work	written work and laboratory report	Control work
K1	is aware of the importance of knowledge in solving engineering problems and knows examples and understands the reasons for machines that led to serious financial, environmental and social losses	K-KK01, K-KK02	laboratory work	written work and laboratory report	Control work

Literature and teaching aids
Primary literature: [1] Han J., Kim D., Sunwoo M.: State-of-charge estimation of lead-acid 1 using adaptive extended Kalman filter. Journal of Power Sources 2009 No 188 [2] Puchalski A., Łazarz B., Chaari F., Komorska I., Zimroz R. Advances in Technical Diagnostics II: Proceedings of the 7th International Congress on Technical Diagnostics, ICTD 2022, 14–16 September 2022, Radom [3] Horst Czichos. Handbook of Technical Diagnostics. Fundamentals and Application to Structures and Systems. Springer 2013 [4] D. Berndt, "Maintenance-Free Batteries: A Handbook of Battery Technology" (3rd edition), Research Studies Press, New York, 2003 [5] W. Lotko. Wybrane zagadnienia diagnostyki pojazdów. Politechnika Radomska 2009 [6] Żółtowski B., Cempel C., Inżynieria diagnostyki maszyn. Instytut Technologii Eksploatacji, Radom 2004. [7] Scheffer C., Girdhar P.: Machinery Vibration Analaysis and Predictive Maintenance, Elsevier, 2004. [8] Lyon R.H.: Machinery Noise and Diagnostics Imprint: Butterworth Heinemann 1987 eBook ISBN: 9781483289458 [9] Górski K.: Laboratorium komputerowego wspomagania diagnostyki pojazdów. Wydawnictwo Politechniki Radomskiej. Radom 2010 Additional literature: [1] https://bibliotekanauki.pl/articles/97625.pdf [2] https://rpitst.com/img/ebook/1710930886_bdadc77b0a046ced1bd0.pdf [3] https://upcommons.upc.edu/bitstream/handle/2099.1/11280/memoria.pdf?sequence=1&isAllowed=y [4] https://archive.org/details/przetw_sygn_2003 [5] http://www.diagnostyka.net.pl/Topic-Technical+diagnostics/3947 [6] http://pe.org.pl/articles/2011/10/66.pdf

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/lab	X	32[h]
Preparation for lectures/lab ,	93 [h]	X
Total student workload	93 [h]/ 3.72ECTS	32 [h]/ 1.28ECTS
ECTS points per subject	5 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).