SYLLABUS

Course description

Course code	Course	Podstawy termodynamiki technicznej
ME/O/I/ST/ A7		Fundamentals of Technical Thermodynamics
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)		4
Affiliation with a group of classes		A. Group of basic course
Course status		Obligatory

Types of classes, instruction hours, ECTS credits	Types of classes	Number of instruction hours	Number of ECTS credits
	Lecture	15 [h]	5 ECTS
	Classes	15 [h]	
	Lab	30 [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	5 ECTS
	with qualifications	It is used to acquire engineering competences by the student	5 ECTS
	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 mathematics, physics and chemistry
Department	Faculty of Mechanical Engineering
Coordinator	DSc, PhD, Eng. Michał Pająk, prof. URad
The website of the basic organizational unit	http://wm.uniwersytetradom.pl
E-mail address, phone number of the coordinator	m.pajak@urad.edu.pl

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

Learning Objective:	C1 - Assimilation by students of the basic laws and concepts in the field of thermodynamics.

	C2 - Practical use of theoretical knowledge when solving problems in the field of mathematical tasks and exercises. C3 - Preparing students to conduct scientific research.
Curriculum Content:	The content of the classes is related to the conducted scientific research. Lecture: 1. Subject and methods of thermodynamic research. Basic concepts and definitions. Substance and energy. 2. Types of energy. Work and heat as ways of transferring energy between thermodynamic systems. The first law of thermodynamics. 3. Energy balance of closed and open systems. Substance models. 4. An ideal gas as an example of a simple system. Properties, equations and characteristic transformations of ideal gases. 5. Polytropic changes. Entropy and reversibility. Irreversibility and dissipation effects. Thermodynamic cycles and model gas cycles of thermal devices. 6. Internal combustion engines, refrigerators and heating pumps. Thermal efficiency of motor circuits and coefficient of performance of cooling and heating circuits. 7. The Second Law of Thermodynamics and its equivalent formulations. Characteristic irreversible changes. Fundamentals of thermostatic gas mixtures. 8. Parameters and transformations of humid air. Saturated and superheated steam: properties and characteristic transformations. Real gases. Classes: 1. Systems of units. International System of Units SI. 2. Using the equation of state and other mathematical relationships to determine the parameters of the ideal gas state and its specific heat. 3. Balancing the energy exchange between the thermodynamic system and the environment on the basis of the first law of thermodynamics. 4. Quantitative analysis of energy conversion processes - determination of energy quantities (heat, volumetric work and technical work) characterizing reversible transformations of ideal gases. 5. Interpretation of polytropic transformations on diagrams of work and heat. 6. Qualitative analysis of energy conversion processes - determination of energy conversion efficiency on the basis of the second law of thermodynamics. 7. Determination of the thermal efficiency of engine gas cycles and coefficient of performance of gas cooling and heating cycles. 8. Calculation of parameters of humid air and analysis of its typical thermodynamic transformations. 9. Determining the properties of saturated and superheated steam using tables and graphs. 10. Interpretation of characteristic transformations of saturated and superheated steam on diagrams; work, heat and the Mollier diagram. Laboratory: 1. Measurement of the heat of combustion. 2. Measurement of the moisture content of solid fuels. 3. Determination of the characteristics of the resistance temperature sensor 4. Determination of air humidity. 5. Marking of pressure gauges for measuring high pressures. 6. Marking micromanometers. 7. Measurements of calorific value of solid and liquid fuels. 8. Thermocouple gauge. 9. Measurement of the relative viscosity of liquids. 10. Isothermal transformation.

	11. Isobaric transformation. 12 Isochoric transformation. 13. Determination of the ignition temperature of liquid fuels using the Pensky-Martens method. 14. Determination of superheated steam parameters
Didactic (educational) methods:	Conventional lecture with the use of audiovisual means, verbal problem method. Conventional classes, verbal problem method. Laboratory.
Course assessment type, the criteria for assessing the achieved learning outcomes, and the method of calculating the final grade:	The condition for passing a subject is to obtain all the required learning outcomes specified for a given subject. Obtaining positive grades in all forms of classes included in a given subject is tantamount to passing it and obtaining by the student the number of ECTS points assigned to this subject. The method of calculating the final grade for the course is specified in the study regulations.

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	has knowledge in the area of physics, including the basics of mechanics, thermodynamics, optics, electricity and magnetism, nuclear physics, solid state physics and elements of quantum physics, including the knowledge needed to understand, describe and use physical phenomena in the design, manufacturing and operation of mechanical systems;	K_WG02	Lectures Classes	Final grade	Exam
W2	has knowledge of fluid mechanics and technical thermodynamics required to understand the construction and operation of mechanical, mechatronic;	K_WG07	Lectures Classes	Final grade	Exam
U1	can plan and conduct experiments, including measurements and computer simulations, interpret the results obtained and draw conclusions;	K_UW13	Laboratory	Final grade	Test
K1	is ready to complete and critically evaluate specialized knowledge and is able to select sources of knowledge and methods of learning appropriate for himself/herself and others;	K_KK01	Laboratory	Final grade	Test
K2	is willing to comprehensively analyze and effectively carry out assigned tasks, and in the event of difficulties in solving them, use expert opinion;	K_KK02	Laboratory	Verbal evaluation	Verbal evaluation

Literature and teaching aids
1. Thermodynamics: An Engineering Approach by Yunus Cengel, Michael Boles, McGraw-Hill Education, 2014 2. Fundamentals of Engineering Thermodynamics by Michael J. Moran, Howard N. Shapiro, Daisie D. Boettner, Margaret B. Bailey, Wiley, 2018 3. Thermodynamics For Dummies by Mike Pauken, For Dummies, 2011 4. Refrigeration and Air Conditioning: An Introduction to HVAC by AHRI, Larry Jeffus, Prentice Hall, 2004

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	60[h]
Preparation for lectures/classes/lab , Preparation for ... credit / exam	65 [h]	X
Total student workload Preparation for ... credit / exam	65 [h]/ 2,5ECTS	60 [h]/ 2,5ECTS
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).