

## SYLLABUS

### Course description

Course code	Course	<b>PROJEKTOWANIE URZĄDZEŃ ENERGETYCZNYCH</b>		
MB/O/I/NST/C2A.8		<b>DESIGN OF ENERGY DEVICES</b>		
Language of instruction	English			
Academic year	2023/2024			
<b>field of study:</b>	Mechanical engineering			
<b>field of specialisation:</b>	Designing and Manufacturing of Machines			
Educational level	first-cycle studies			
Education profile	General academic			
Mode of study	Part-time studies			
Semester(s)	5			
Affiliation with a group of classes	Specialization module			
Course status	obligatory			
Types of classes, instruction hours, ECTS credits	Types of classes	Number of instruction hours	Number of ECTS credits	
	Lecture	8 [h]	3 ECTS	
	Classes	16 [h]		
Linkage of the course	with the education profile	Associated with the conducted scientific activity in the discipline to which the field of study is assigned		3 ECTS
	with qualifications	It serves the student's acquisition of engineering competencies		3 ECTS
	with science discipline	Mechanical engineering		2 ECTS
Form of teaching	Traditional – classes organized at the University /classes conducted using online learning methods and techniques			
Prerequisites	The student should have basic knowledge in the field subjects: physics, basic chemistry, mathematics and economics, machine science in RES and GO, technologies in renewable energy, computer-aided design.			
Department	Faculty of Mechanical Engineering			
Coordinator	dr inż. Sylwester Stawarz			
The website of the basic organizational unit	<a href="http://www.uniwersytetradom.pl">www.uniwersytetradom.pl</a>			
E-mail address, phone number of the coordinator	stawarz@uthrad.pl, tel. 48 361 76 98			

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

Learning Objective:	Familiarize students with the general principles of designing RES installations. Developing the ability to develop a project of systems and devices for the acquisition and use of renewable energy sources. Presentation of information on the design of devices and tools used in the production of energy from renewable sources.
Curriculum Content:	<p>The content of the classes is related to the conducted scientific research.</p> <p>A. Lecture topics          Basic energy units and their equivalents. Characteristics of renewable energy sources and possibilities of using renewable energy in Poland. Devices and technologies, their purpose for the generation of electricity, heat and biofuels: 1) wind energy: small and large wind farms and offshore wind farms, 2) solar energy converters: solar collectors (flat and vacuum) and photovoltaic systems, 3) biogas plants: agricultural, sewage treatment plants, landfills, 4) biofuel plants: bioethanol and biodiesel and new technologies, 5) solid biofuel (biomass) boilers: heating, energy, 6) small hydropower plants, 7) geothermal systems: geothermal heating plants (deep geothermal energy), individual heating systems (shallow geothermal energy in cooperation with heat pumps).          Ecological and economic aspects of using alternative energy sources. Guidelines and requirements for the assembly and assembly of subassemblies of lines used to obtain and use RES. Design concepts of energy systems based on RES in households and in the Region. Principles and algorithms for designing solar and photovoltaic installations, obtaining heat from the Earth, water energy, wind and biofuels.</p> <p>B. The issues of design exercises          Solar energy: resources, solar systems, calculation of the installation of solar collectors and photovoltaic cells and modules, design of the photovoltaic system. Wind energy: resources, wind farms, rules and algorithms for designing masts and towers of wind farms. Rules for locating wind farms in the field. Calculations of wind turbines - potential applications. Water energy: resources, small and large hydropower plants, hydrological calculations, selection of turbines. Geothermal energy - designing heat pump installations. Biomass heating installations. Ways of storing energy in RES installations. Basic technological calculations of devices used for energy processing of biomass.</p>
Didactic (educational) methods:	<p>Conventional lecture with the use of audiovisual means, verbal problem method.          Project: self-implementation by students prepared task based on previously established assumptions.</p>
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.

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 field of physics, including the basics of mechanics, thermodynamics, electricity, including the knowledge needed to understand, describe and use physical phenomena in the design of power devices.	K_WG02	Lecture	Final test	Arithmetic mean of sub-question scores
W2	Has basic knowledge of development trends in the field of design, manufacture, construction and operation of power equipment.	K_WG14	Lecture	Final test	Arithmetic mean of sub-question scores
W3	Knows and understands the principles of designing power devices.	K_WG08 K_WG09	Lecture	Final test	Arithmetic mean of sub-question scores
U1	Can, select materials, design and implement a simple device in the field of energy, using appropriate methods, techniques and tools.	K_UW09 K_UW10 K_UW11 K_UW14	Laboratory exercises	Passing individual practical exercises	Arithmetic mean of sub-question scores
U2	He can work in a team.	K_UO20	Laboratory exercises	Passing individual practical exercises	Arithmetic mean of sub-question scores
K1	He is ready to analyze the tasks assigned for implementation in terms of determining priorities, serving the maximum efficiency of task performance, and the comprehensive effects of its implementation.	K_KK01	Lecture	Final test	Arithmetic mean of sub-question scores

Literature and teaching aids
<p>Basic literature:</p> <ol style="list-style-type: none"> <li>Lewandowski W.M, 2013. "Pro-ecological renewable energy sources.", WNT Warsaw</li> <li>Klugmann-Radziemska E., 2007. "Renewable energy sources - calculation examples", Wydawnictwo Politechniki Gdańskiej.</li> <li>Michałowski S., Plutecki J. 1975. Hydropower. WNT, Warsaw. Mikielwicz J., Cieśliński J.: Unconventional energy conversion devices and systems. ed. Polish Academy of Sciences. Institute of Fluid Flow Machinery. Wrocław 1999.</li> <li>Fugiel P. 1996. Location of wind farms. IBMER Warsaw. Rubik M.: Heat pumps - a guide. Publishing House Information Center of Installation Technology in Construction. Warsaw 1999.</li> <li>Rubik M.: Heat pumps in low-temperature geothermal systems. Mulico Publishing House 2011.</li> </ol> <p>Supplementary literature:</p> <ol style="list-style-type: none"> <li>Ulbrich R. 2000. "Alternative energy sources", Wyd. Opole University of Technology.</li> <li>Sobierajski J., Starzomska M., Piotrowski J.: Renewable energy sources: general information. ed. Kielce University of Technology. Kielce 2009.</li> </ol>

Student workload required to achieve the assumed learning outcomes – the balance of ECTS credits			
Attendance, participation	Student workload [h].		
	Other contact hours (IGK)	Student's self-study hours Classes without a teacher (ZBN)	Classes
Participation in lectures	X	X	8 [h]
Participation in classes/laboratory classes	X	X	16 [h]
Meeting with teachers during their duty hours	8 [h]	X	X
Preparation for lectures/classes/.... , Preparation for credit / exam	X	24 [h] 25 [h]	X
Total student workload	8 [h]/ 0,4 ECTS	43 [h]/ 1,7 ECTS	24 [h]/ 0,9 ECTS
ECTS credits for the course	75 h/ 3 ECTS		

Additional information, comments
<p>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.</p> <p>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).</p>

