

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Unconventional Energy Sources in Urban Management		Code 1010102231010132022
Field of study Environmental Engineering Second-cycle	Profile of study (general academic, practical) (brak)	Year /Semester 2 / 3
Elective path/specialty Heating, Air Conditioning and Air Protection	Subject offered in: Polish	Course (compulsory, elective) obligatory
Cycle of study: Second-cycle studies	Form of study (full-time, part-time) full-time	
No. of hours Lecture: 30 Classes: - Laboratory: - Project/seminars: 15		No. of credits 2
Status of the course in the study program (Basic, major, other) (brak)		(university-wide, from another field) (brak)
Education areas and fields of science and art		ECTS distribution (number and %)
Responsible for subject / lecturer: dr inż. Grzegorz Krzyżaniak email: grzegorz.krzyzaniak@put.poznan.pl tel. 61 665 2034 Faculty of Civil and Environmental Engineering ul. Piotrowo 5 60-965 Poznań		Responsible for subject / lecturer: mgr inż. Michał Klimas email: michal.klimas@put.poznan.pl tel. 616652414 Faculty of Civil and Environmental Engineering ul. Piotrowo 5 60-965 Poznań
Prerequisites in terms of knowledge, skills and social competencies:		
1	Knowledge	Knowledge of selected topics in mathematics, physics, engineering mechanics, materials strength and thermodynamics Knowledge of selected topics in physics, chemistry and biology. Knowledge of basic principles and laws of thermodynamics, heat transfer and fluid mechanics.
2	Skills	Use the knowledge to explain processes and phenomena in mechanical and flow devices The application of known physics laws to describe the phenomenon in devices converting energy from non-renewable sources. Determination of indicators to assess the energy efficiency and economic of non-renewable energy sources systems.
3	Social competencies	Awareness of the need to constantly update and supplement knowledge and skills Able to share their skills with people in the group
Assumptions and objectives of the course: 1. Purchase by the student knowledge of methods and plants used to generate energy from alternative energy sources		
Study outcomes and reference to the educational results for a field of study		
Knowledge: 1. . The student has an ordered theoretical knowledge in physics, chemistry, biology and other fields relevant environmental engineering in order to identify and solve complex tasks in the field of environmental engineering - [K2_W01] 2. The student has an ordered theoretical knowledge of the possibility of obtaining energy from non-renewable sources of energy - [K2_W05] 3. The student has knowledge of principles, schemes and construction of AES units and types of energy conversion - [K2_W05] 4. The student has an ordered and detailed knowledge of the life cycle of the units, facilities, and technical systems used in environmental engineering (solar collectors, heat pumps, wind turbines, photovoltaic cells) - [K2_W06] 5. . The student knows the basic methods, techniques, tools and materials used in technologies based on renewable and non-renewable primary energy sources - [K2_W07] 6. The student knows the general principles for the creation and development of forms of individual enterprises, utilizing knowledge of environmental engineering - [K2_W11]		
Skills:		

<p>1. The student is able to capture, analyze and appropriately use information from Polish and foreign literature in the field of alternative energy sources - [K2_U01]</p> <p>2. The student is able to calculate, design and select the system to generate energy from alternative energy sources - [K2_U07, K2_U08]</p> <p>3. Students can compare on the basis of calculations of various energy efficiency of equipment and systems for obtaining energy from alternative energy sources - [K2_U11, K2_U12]</p> <p>4. . The student is able to make a preliminary economic analysis in the field of engineering activities undertaken in relation to renewable and non-renewable primary energy sources - - [K2_U14]</p>
<p>Social competencies:</p> <p>1. The student understands the need for systematic broadening its competence - [-]</p> <p>2. The student is able to work in group and fulfill different tasks - [-]</p> <p>3. The student understands the importance of engineering and its impact on the environment - [-]</p>

Assessment methods of study outcomes		
Lectures: Written final test		
Project: Execution and completion of design projects in the field of alternative energy sources		
Course description		
<p>Conventional and non-conventional energy sources.</p> <p>Solar energy: types of solar collectors, construction and operation of solar flat collectors, construction, operation and selection of solar vacuum collectors.</p> <p>Heat Pumps: The compressor heat pump. Principle of operation, the definition of the COP, types of heat sources, examples of applications of heat pumps;</p> <p>Absorption heat pumps, Thermoelectric heat pumps.</p> <p>Geothermal water: Exploitation of geothermal sources, geothermal heating plants, monovalent and bivalent systems.</p> <p>Biomass: Energy potential of biomass, use of biomass, combustion appliances examples.</p> <p>Wind energy and its use: wind energy potential, types of wind turbines, wind turbines, basic information.</p> <p>Photovoltaics: design and operation, examples of applications.</p> <p>Theme of design project:</p> <p>1. The heat pump and a solar collector as a non-conventional heat source to heat the hot water in apartment building</p>		
Basic bibliography:		
Additional bibliography:		
Result of average student's workload		
Activity	Time (working hours)	
1. Participation in lectures	30	
2. Participation in project exercises	15	
3. Execution of 3 design projects (student individual work)	20	
4. Preparation (at home) for the project exercises	5	
5. Participation in consultations related to the project exercises	2	
6. . Preparation for the final test	10	
Student's workload		
Source of workload	hours	ECTS
Total workload	50	2
Contact hours	30	1
Practical activities	20	1