

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Boilers and Renewable Energy Sources		Code 1010632221010637579
Field of study Mechanical Engineering	Profile of study (general academic, practical) (brak)	Year /Semester 1 / 2
Elective path/specialty Thermal Engineering	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: 2 Classes: - Laboratory: - Project/seminars: -		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 technical sciences Technical sciences		ECTS distribution (number and %) 2 100% 2 100%
Responsible for subject / lecturer: dr hab. inż. Jarosław Bartoszewicz, prof nadzw email: jaroslaw.bartoszewicz@put.poznan.pl tel. 61 665-2251 Wydział Maszyn Roboczych i Transportu ul. Piotrowo 3, 60-965 Poznań		Responsible for subject / lecturer: dr inż. Rafał Urbaniak email: rafal.urbaniak@put.poznan.pl tel. 061 665-2331 Wydział Maszyn Roboczych i Transportu ul. Piotrowo 3, 60-965 Poznań
Prerequisites in terms of knowledge, skills and social competencies:		
1	Knowledge	Basic knowledge of technical thermodynamics, fluid mechanics and heat transfer. Basic knowledge of construction and the basic messages of the maszynoznawstwa
2	Skills	Student knows how to use the concepts and methods in the description of thermodynamic systems and can analyze complex mechanical systems.
3	Social competencies	społeczne The student can work in a group, taking in her different roles to solve posed in front of it tasks.
Assumptions and objectives of the course: Understanding the design of the boiler and heating devices, components, principles of calculation; familiarize yourself with the construction and the types of transmission networks; knowledge of issues related to the selection of equipment and their operation.		
Study outcomes and reference to the educational results for a field of study		
Knowledge:		
1. Has a basic knowledge of the fundamentals of machine design and theory of machines and mechanisms, including mechanical vibrations. - [K1A_W05]		
2. Has a basic knowledge in the field of technical thermodynamics, IE. the theory of thermodynamic transformation, heat flow, thermal and heating equipment, drying and cooling - [K1A_W07]		
Skills:		
1. Has the ability of self-study using modern teaching tools, such as remote lectures, Web site and database, educational programs, e-books - [K1A_U06]		
2. Can carry out technical calculations in the field of fluid mechanics and thermodynamics, such as for example. heat balances and pressure loss in pipes. - [K1A_U19]		
3. It can competently advise in the selection of the machines for the application in the industry covered by the selected speciality based on the acquired knowledge about the flu machines - [K1A_U27]		
Social competencies:		
1. Understand the validity of and understand non-technical aspects and effects of mechanical engineering activities and its impact on the environment and responsibility for decisions - [K1A_K02]		

Assessment methods of study outcomes		
Written examination, evaluation of design work		
Course description		
<p>General messages about the construction of boilers and heating devices. Basic concepts. The base fuel. The classification of the boiler equipment. The creation policy determinations of boilers. Boiler constructions. General characteristics of the combustion of fuels. The main design features of the components of the boiler equipment. Basis of calculation energy boiler equipment. The energy balance. Heat loss. The process of heat transfer in the furnace Chamber and in the boiler. Resistance to the flow of exhaust gases and air. Types and kinds of burners for combustion of oil and gas. The characteristics of the materials used in the construction of boiler equipment. General rules for preparation of water to power boilers. Pipeline construction. Classification of thermal network. Connection systems. Used fittings, accessories, thermal insulation. Hydraulic calculation of heat network. The design of the pressure chart. Rules for the implementation of the network documentation.</p>		
Basic bibliography:		
<ol style="list-style-type: none"> 1. P. Orłowski, W. Dobrzański, E. Szwarc, Kotły parowe konstrukcja i obliczenia, WNT, Warszawa 1979 2. S. Kruczek, Kotły. Konstrukcja i obliczenia, Wydawnictwo Politechniki Wrocławskiej. Wrocław 2001 3. J. Jaroński, Techniki czystego spalania, WN-T, Warszawa 1996. 		
Additional bibliography:		
<ol style="list-style-type: none"> 1. P. Orłowski, Kotły parowe w energetyce przemysłowej. Zagadnienia eksploatacyjne, WNT, Warszawa 1976. 2. K. Krygier, T. Klinger, J. Sewerynik, Ogrzewnictwo, wentylacja, klimatyzacja, Wydawnictwo Szkolne i Pedagogiczne, Warszawa 1997. 		
Result of average student's workload		
Activity	Time (working hours)	
1. Preparing for a lecture and course design	10	
2. Lecture classes and design	45	
3. Fixation of the lecture	15	
4. Consultation	15	
5. Preparation for exam	24	
6. Exam	1	
Student's workload		
Source of workload	hours	ECTS
Total workload	60	2
Contact hours	34	2
Practical activities	1	1