

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Heating		Code 1010134251010130187
Field of study Environmental Engineering Extramural First-	Profile of study (general academic, practical) general academic	Year /Semester 3 / 5
Elective path/specialty -	Subject offered in: Polish	Course (compulsory, elective) obligatory
Cycle of study: First-cycle studies	Form of study (full-time, part-time) part-time	
No. of hours Lecture: 20 Classes: 6 Laboratory: - Project/seminars: 14		No. of credits 5
Status of the course in the study program (Basic, major, other) other		(university-wide, from another field) university-wide
Education areas and fields of science and art technical sciences Technical sciences		ECTS distribution (number and %) 5 100% 5 100%
Responsible for subject / lecturer: prof. dr hab. inż. Halina Koczyk email: halina.koczyk@put.poznan.pl tel. (61) 6652532 Faculty of Civil and Environmental Engineering ul. Piotrowo 5 60-965 Poznań		
Prerequisites in terms of knowledge, skills and social competencies:		
1	Knowledge	The student has knowledge in the following areas: mathematics, building physics, basics of thermal engineering and fluid mechanics, needed to formulate and solve simple tasks. The student is familiar with applicable building envelopes solutions.
2	Skills	The student is able to solve the problems of fluid mechanics and thermal engineering, and can draw and read construction drawings.
3	Social competencies	The student is aware of the need to constantly update and supplement knowledge and skills.
Assumptions and objectives of the course: Acquiring by students basic knowledge and skills in the scope of the basics of water heating design		
Study outcomes and reference to the educational results for a field of study		
Knowledge:		
1. The student has knowledge of thermal parameters of the internal environment associated with heating systems. - [-] 2. The student knows the basic solutions of heating installations of buildings and their components. - [-] 3. The student knows the basic requirements for building thermal protection. - [-] 4. The student has the knowlegde of the calculation of heat transfer coefficients for building envelopes, designed heat load for individual rooms and the building, selection of radiators and protection of the system. - [-] 5. The student has knowledge of hydraulic calculations of water heating installations, including the determination of circulation pressure, pressure losses in circuits and installation characteristics. - [-]		
Skills:		
1. The student can propose a concept solution for the heating system in a small building with a single utility function as well as a developed view of central heating system - [-] 2. The student can calculate the designed heat load for individual rooms and the building as well as design the basic elements of central heating installation. - [-]		
Social competencies:		
1. The student understands the need for teamwork in solving theoretical and practical problems. - [-] 2. The student is aware of the importance and understand the non-technical consequences of engineering activities, including the impact on the environment. - [-] 3. The student sees the need for extending their competence systematically. - [-]		

Assessment methods of study outcomes		
<p>Recitation classes ? are credited on the basis of successful completion of the final test tasks.</p> <p>Class Projects are credited on the basis of the project design of the heating system for a small building made in traditional technique and an oral defence of the project.</p>		
Course description		
<p>Factors of external climate and their effect on the heat balance of the building. Thermal comfort. The external climate factors and their impact on the building energy balance. Calculation of heat and moisture transfer for building envelopes. Thermal protection requirements according to building regulations. Calculations of heat transfer coefficients for the envelopes consisting of homogeneous and heterogenous layers. Thermal bridges, their effects and how they can be included in the design calculations. The heat balance of buildings under design conditions and during the heating season. Calculations of the design heat load. Tasks and classification of heating systems. Schemes of modern heating solutions for housing levels. Expansion facilities in heating systems. Diagrams of solutions of the levels of housing in modern heating systems. Protection of heating systems (diagrams and calculation formulas). Principles of pipe dimensioning in water heating. Circulation pressure. Pressure losses of circuits. The definition of pipe section and circuit. Pipes used in heating installations. Materials and their characteristics. Compensation for thermal line extension. Thermal insulation of heating installations. . Thermostatic valves. Hydraulic stabilization of heating system. Types of regulators, installation diagrams. Heaters classification. Requirements and rules for the selection of convection heaters.</p>		
<p>Basic bibliography:</p> <p>1. Koczyk H., Antoniewicz B., Basińska M., Górka A., Makowska-Hess R.: Ogrzewnictwo Praktyczne projektowanie, montaż, certyfikacja energetyczna, eksploatacja Systherm Serwis, Poznań 2009</p> <p>2. Recknagel, Schramek, Sprenger, Honmann: Kompendium wiedzy OGRZEWNICTWO, KLIMATYZACJA, CIEPŁA WODA, CHŁODNICTWO 08/09 OMNI SCALA, Wrocław, 2008</p>		
<p>Additional bibliography:</p> <p>1. Klemm P. (red.): Budownictwo ogólne tom II. Wydawnictwo Arkady 2005</p>		
Result of average student's workload		
Activity	Time (working hours)	
Student's workload		
Source of workload	hours	ECTS
Total workload	125	5
Contact hours	45	2
Practical activities	20	1