STUDY MODULE DESCRIPTION FORM

Name of the module/subject **(-)**		Code **1010101271010137728**
Field of study **Environmental Engineering First-cycle Studies**	Profile of study (general academic, practical) **(brak)**	Year /Semester **4 / 7**
Elective path/specialty **-**	Subject offered in: **Polish**	Course (compulsory, elective) **elective**
Cycle of study: **First-cycle studies**	Form of study (full-time,part-time) **full-time**	
No. of hours Lecture: **15** Classes: **15** Laboratory: **-** Project/seminars: **-**		No. of credits **4**
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**		ECTS distribution (number and %) **4 100%**

Responsible for subject / lecturer:

dr inż. Fabian Cybichowski
email: fabian.cybichowski@put.poznan.pl
tel. 61 665 24 14
Faculty of Civil and Environmental Engineering
ul. Piotrowo 5 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Fundamentals of combustion processes. Incompressible fluid flows in pipes, pressure loss, pump selection. Pressure, pressure units. Fundamentals of heat exchange. Strength of materials. Control systems.
2	**Skills**	Calculation of simple and complex hydraulic networks. Calculation of heat transfer through flat and curved walls. Selection of control equipment for hydraulic networks.
3	**Social competencies**	Ability to work in team. Awareness of the need to continually update and supplement one's knowledge and skills.

Assumptions and objectives of the course:

To teach students basic information about municipal and industrial heat distribution systems, including: heat source, pipe line system, heat transfer unit. To teach students basic information about construction, operation and design of low and medium pressure natural gas distribution systems. Course is continued on next term.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Student knows pronciples of operation of municipal and industrial heat distribution systems, based on conventional heat sources - [K_W04, K_W05]
2. Student has the knowledge about construction, design and operation of: medium size boiler house (water and steam) and relevant pipe lines and heat transfer units - [K_W05,K_W06,K_W07]
3. Student has the knowledge about design and operation of district heating systems including: heat source, pipe lines, heat transfer units - [K_W05,K_W06,K_W07]
4. Student has a basic knowledge about cogeneration systems - [K_W04, K_W06]

Skills:

1. Student can calculate heat demand for medium size residential and industrial systems - [K_U13, K_U14]
2. Student knows how to design medium size boiler house (water and steam) including control and safety systems - [K_U01, K_U04, K_U07, K_U13, K_U14]
3. Student knows how to design and analyze heat distribution system, including: heat source, pipe lines, district heating substation, basic control equipment - [K_U01,K_U03, K_U07,K_U13, K_U14]

Social competencies:

1. Student is aware of the purpose of municipal and industrial heat distribution systems - [K_K02, K_K]
2. Student understands the significance of team work in resolving theoretical and practical problems - [K_K03]

Assessment methods of study outcomes

Lecture: Written exam

Excersize classes: written test

Course description

Municipal heating systems - comparative analysis.

Heating demands calculations: Qch, Qw,Qwh,Qt. Ordered chart of heat demands for heat source.

Fundamentals of boiler construction, operation and control for coal, oil and gas fired boilers.

Sizing and location of central heat source in a town.

District boiler houses: low and high temperature systems, technical diagrams, different control strategies for hydronic and capacity balancing, control and safety systems, auxiliary systems.

Distribution systems, low and high temperature systems, calculations, sizing, hydronic balancing, other practical considerations.

District heating substations: technical diagrams of substations in low and high temperature distribution systems, delivering heat for district central heating and domestic hot water systems, different control strategies for hydronic and capacity balancing, control and safety systems, auxiliary systems.

Pressure loss chart for heat station and district heating.

Example problems for design exercises (in small teams): designing district heating system for housing estate, including some public buildings. The system consist of boiler house, gas system connection, part of heat distribution system and example substation.

Medium pressure steam heat stations: example technical diagrams, control and safety systems, calculations and sizing of pipelines and equipment, other considerations.

Basic bibliography:

1. Szargut J. , Ziębik A., Podstawy energetyki cieplnej, PWN, Warszawa, 2000.
2. Szkarłowski A., Łatowski L.: Ciepłownictwo, WNT 2006
3. Górzyński J., Urbaniec K., Wytwarzanie i użytkowanie energii w przemyśle, Wyd. Politechniki Warszawskiej, 2000
4. Krygier K., Sieci ciepłownicze, Oficyna Wydawnicza PW, Warszawa 2006
5. Nantka M., Ogrzewnictwo i ciepłownictwo; t.1 i 2; Wydawnictwo Politechniki Śląskiej, Gliwice 2010
6. Ciepłownictwo, eksploatacja, projektowanie, inwestycje; praca zbiorowa; (zeszyty tematyczne); Unia Ciepłownicza 1995.

Additional bibliography:

1. Turschmidt R.: Kotłownie i elektrociepłownie przemysłowe, Arkady, 1988
2. Krygier K., Sieci cieplne, materiały do ćwiczeń projektowych, Oficyna Wyd. PW, Warszawa 1993
3. Żarski K. Obiegi wodne i parowe w kotłowniach; Wyd. Ośrodek Informacji Technika Instalacyjna w Budownictwie; Warszawa 2000
4. Mizielińska K., Olszak J., Gazowe i olejowe źródła ciepła małej mocy, Oficyna Wyd. PW, Warszawa 2006

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	15
2. Participation in exercise classes	15
3. Preparation for final tests	5

Student's workload

Source of workload	hours	ECTS
Total workload	85	4
Contact hours	30	4
Practical activities	40	2