COURSE DESCRIPTION CARD - SYLLABUS

Course name
Heating [N1IŚrod2>Ogrz]

Course

Field of study
Environmental Engineering

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
20

Laboratory classes
0

Other (e.g. online)
0

Tutorials
10

Projects/seminars
20

Number of credit points

5,00

Coordinators

dr hab. inż. Małgorzata Basińska prof. PP
malgorzata.basinska@put.poznan.pl

prof. dr hab. inż. Halina Koczyk
halina.koczyk@put.poznan.pl

Lecturers

Prerequisites

Basic knowledge of mathematics, physics. Basic knowledge of subjects: Thermal engineering, Construction and engineering structures and Materials science She/he can use the available sources of information. She/he can choose the construction of building partitions. She/he can determine the heat transfer coefficient for a simple partition. She/he knows the processes of heat exchange in the partition. She/he knows how to choose the diameter of the pipes. She/he awareness of the need to constantly update and supplement building knowledge and engineering skills. She/he can work on a task independently and collaborate in a team.

Course objective

The aim of the course is for students to acquire basic knowledge and skills in the field of the basics of water heating design, including the determination of the usable energy of the building

Course-related learning outcomes

Knowledge:
1. Student knows the requirements of thermal protection of buildings and energy assessment of heating systems.
2. Knows the provisions of the construction law related to heating installations.
3. Has a structured, theoretically based general knowledge of the basic issues related to the installation of central heating.
4. Has structured knowledge of development trends in the area of heating installations.
5. Knows the basic solutions of building heating systems and their elements.
6. Knows calculation methods, design techniques, tools and materials used in solving engineering tasks related to the design of heating systems.

Skills:
1. The student is able to propose a concept of a solution for a heating system for a small building with a different utility function and to draw up a description of the central heating system. use and convert units of physical quantities used in heating.
2. Can calculate the design heat load for rooms and the building and assess the heating and ventilation systems in terms of usable energy consumption.
3. Can design a central heating installation, configure a small heat source for central heating purposes. and justify the selection of components by calculation.

Social competences:
1. The student understands the need for teamwork in solving theoretical and practical problems.
2. Is aware of the importance and understands the non-technical effects of engineering activities, including the impact on the environment.
3. Sees the need to systematically deepen and expand its competences.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures:
Exam in the form of questions (and/or): open, calculation, drawing, various types of tests.
Rating: 0-50%: 2,0; 51-60%: 3,0; 61-70%: 3,5; 71-80%: 4,0; 81-90%: 4,5; 91-100%: 5,0.
The final grade will be increased by +0.5 grade in the case of receiving at least a grade of 4.5 from tutorials and design exercises.
Tutorials:
Final test with computational tasks in the last class. Rating: 0-50%: 2,0; 51-60%: 3,0; 61-70%: 3,5; 71-80%: 4,0; 81-90%: 4,5; 91-100%: 5,0.
Project:
Assessment of the design of the heating system of a small building constructed using traditional techniques, together with an oral defense.
The share of individual components of the assessment: design - 60%, defense - 40%. Each component passed at least 51%.
Percentage scale: 0-50%: 2.0; 51-60%: 3.0; 61-70%: 3.5; 71-80%: 4.0; 81-90%: 4.5; 91-100%: 5.0.

Programme content

Lectures:
1. Thermal protection requirements according to building regulation.
2. Calculations of the design heat load.. Thermal bridges, their effects and how they can be included in the design calculations.
4. Selection of central heating system elements.
5. Automation used in heating systems.
6. Operational regulation of central heating installations.

Tutorials:
1. Usable energy for heating and ventilation purposes.
2. Selection of convection heaters.
3. Hydraulic calculations of the central heating system.

Project:

Individual design for a given structure of a l building.

Course topics

Lectures:
1. Thermal protection requirements according to building regulation.
2. Calculations of the energy needs for heating and ventilation purposes.
3. Calculations of the design heat load.. Thermal bridges, their effects and how they can be included in the design calculations.
4. Tasks and classification of heating systems..
5. Protection of heating systems (diagrams and calculation formulas).
6. Principles of dimensioning water heating systems.
7. Pipes used in central heating installations
8. Classification of radiators. Differences in the selection of surface and traditional radiators.
9. Requirements and selection rules for convection heaters.
10. Thermal and technological requirements for floor heating. Radiator and floor systems.
11. Automation used in heating systems.
12. Tasks and types of operating regulation in a building.
13. Pumps in central heating systems Selection rules.
14. Heat sources. Principles of design, selection of boilers and requirements for small boiler rooms (to 50kW).
15. Chimney classification.
16. Gas supply installations for boiler rooms for the gas lighter and heavier than air.
17. Oil supply installations. Oil fuel storage.
18. Heat pumps in small heating installations. Conditions of use.

Tutorials:
1. Calculations of usable energy for heating and ventilation purposes.
2. Arithmetic and logarithmic temperature difference - comparison.
3. Choice of convection heaters.
4. Hydraulic calculations of the central heating system.

Project:
Individual design for a given structure of a residential building. A complete project must be submitted for evaluation. The final evaluation takes into account the execution of the project and its defence. You must score a minimum of 51% on each component. The project includes the following tasks:
• Assumption of heat transfer coefficients of building components.
• Calculation of the design heat load for rooms in a single-family residential building.
• Selection of convection heaters.
• Performing hydraulic calculations of the central heating system.
• Determination of the design heat loss coefficient for the building.
• Calculation of usable energy for heating and ventilation purposes.

Teaching methods

Lectures:
Informative lecture with elements of a conversational lecture; Multimedia presentation; Exercise elements
Problem method; Interactive problem solving
Project:
Individual work on the project; Case study analysis;

Bibliography

Basic:
[1] Koczyk H., Antoniewicz B., Basińska M., Górka A., Makowska-Hess R.: Ogrzewnictwo Praktyczne projektowanie, montaż, certyfikacja energetyczna, eksploatacja Systherm Serwis, Poznań 2009
[2] Recknagel, Schramek, Sprenger, Honmann: Kompendium wiedzy OGRZEWNICTWO, KLIMATYZACJA, CIEPŁA WODA, CHŁODNICTWO 08/09 OMNI SCALA, Wrocław, 2008

Additional:

[1] Chwieduk D.: Energetyka słoneczna budynku Arkady Warszawa 2011
[2] Klemm P. (red.): Budownictwo ogólne tom II. Wydawnictwo Arkady 2005

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,00
Classes requiring direct contact with the teacher	50	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	75	3,00