COURSE DESCRIPTION CARD - SYLLABUS

Course name
External infrastructure [S1BZ1E>IZ]

Course

Field of study
Sustainable Building Engineering

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
15

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Knowledge: Basic knowledge from mathematics, physics, fluid mechanics, in particular: incompressible and compressible fluid flow in pipelines, pressure head losses, pump selection. Pressure, pressure units. The basics of heat exchange. Strength of materials. Skills: Acquaintance of basic terminology in area of environmental engineering and self-education ability. Social competencetes: Ability of working in a team. Awareness of the need to constantly update and supplement knowledge and skills

Course objective

Conveying of the basic knowledge and skills in planning, design and operation of heating systems, gas systems, water supply systems and sewerage systems.

Course-related learning outcomes

Knowledge:
Student has a knowlegde about type, function and characteristic of basic elements of heating systems,

water supply systems and sewerage systems (lecture).
Student has a knowledge about laying heating pipes and sewers in the ground (lecture).
Student knows basis of modeling of pressure piping systems (lecture, project).

Skills:
Student can perform computer simulations in : assessment of simple engineering structures and external infrastructures; clearly show and interpret the obtained results and make a conclusions (project).
Student can perform critical analysis and assess the functioning of the technical solution of existing external infrastructure (project).
Student can make identification and specification of simple engineering tasks in the field of sewage and water supply systems (lecture, project).

Social competences:
Student sees the need for systematic incresing her/his skills and competences.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lecture:
Written final exam with open, problematic questions which verify the knowledge and selected skills .
The final grade on basis of written final exam : 5-6 open questions, exam duration ca. 60 min.
The grading scale (the percentage of points/grade):
0-49 2,0
50-59 3,0
60-69 3,5
70-79 4,0
80-89 4,5
90-100 5,0
Project:
Assessment of the project report and verification of the correctness of obtained solutions of the design task
Final grade as a weighted average of the three grades for the designs of pumping station, water supply system and heating system.
The criteria of project assessment- correctness of calculations; correctness, relevance and completeness of coclusions, the contents of the developed design (including calculations, text and draws), involvement and regularity of the student"s work.
The grading scale (the percentage of points/grade):
0-49 2,0
50-59 3,0
60-69 3,5
70-79 4,0
80-89 4,5
90-100 5,0

Programme content

Lecture 1
Water Supply Systems – basic information: Definitions and basic terms. Types of water supply systems. Types, functions, characteristics of the system components. Retention reservoirs – types, functions and design principles.
Material engineering in water supply systems. Rules for laying pipelines in the ground.
Lecture 2
Methods and tools for the design and analysis of water supply systems: Methods and tools for the hydraulic calculations of water supply systems. Method for determining the water demand for the city. Characteristic flows.
Lecture 3
Basic information about sewerage systems: classification of wastewater and sewarage systems, the types of sewers and their selected parameters, the materials of sewers and basic types of their cross-

sections, location of sewers, laying sewers in the ground, runoff coefficient.
Calculation of rainwater and wastewater flows: basic parameters of the design rainfall, IDF curves, typical wastewater flowrates.
Lecture 4
Types and functions of sewer appurtenances: manholes, street insets, siphon, sewage pumping stations, retention reservoirs, combined sewer overflows, grase and oil traps .
Lecture 5
Heating systems - classification, schemes, fuels, typical sizes, capacity control, regulation of water temperature depending on the ambient air temperature, diagrams and photos of elements of heating systems.
Lecture 6
Balance of thermal needs of customers - the heat demand of objects for heating, ventilation, domestic hot water, boiler selection rules, the graph of load for the heat source.
Lecture 7
Heating and gas sytems – network location, configuration, method of laying the pipes in the ground, the type of medium and the water temperature, the required pressure, the rules for hydraulic calculations and diameter selection, compensation of elongation.
Project 1
Modeling of pressure hydraulic systems in Epanet 2.0: Basics of the water supply system modeling – model objects and attributes. The functionality of the modeling tools. Obtaining and supplementing data for the mathematical modeling of the water supply systems. Determination of calculation method, criteria, boundary conditions and assessment of correctness of calculation results
Project 2
Conceptual design of water supply system modernization: System Analysis, selection of criteria, formulation of the tasks, analysis of variants, assessment of obtained results, selection and dimensioning of system elements. Formulation of conclusions.
Project 3
Conceptual design of sewerage systems: location of sewers, calculation of wastewater flowrates. Hydraulic calculations.
Project 4
Sewage pumping station design and operational analysis: model development (with the use of Epanet 2.0), determination of basic parameter of sewage pumping station, selection of pumps, pump operaing costs.
Project 5
The design of heating system for a residential area with social utility facilities- part 1.
Assessment of heating demand of objects located in the residential area.
Project 6
The design of heating system for a residential area with social utility facilities- part 2.
Location of heating system pipes and assessment of their bury depth. Determination of inner diameters according to heating power and the velocity of water flowrate.
Project 7
The design of heating system for a residential area with social utility facilities- part 3.
Calculation of hydraulic head lossess. Calculation of maximum pipe length without compensation. Selection of compensators.

Course topics

none

Teaching methods

Lecture with the use of multimedia presentation and the elements of seminar lecture and problem-focused lecture.
Project - the design method with the use of informatics tools for modeling and assessment of external infrastructure completed by a lecture with multimedia presentation..

Bibliography

Basic
1. American Society of Heating Refrigerating and Air Condition Engineers, District Heating Guide, 2016,
2. C. Mackenzie-Kennedy, District Heating Thermal Generation and Distribution. A practical Guide to

Centralised Generation and Distribution of Heat Services, Pergamon Press, 2015
3. Mackenzie L.Davis, Water and Wastewater Engineering, Design Principles and Practice, The McGraw-Hill Companies 2010
4. Mazurkiewicz Karolina- learning materials (in english) shared through Moodle platform (lectures)
5. Wastewater Engineering, Treatment and Recovery, Fifth edition, Volume 1, Metcalf & Eddy/ Aecom, 2014
Additional
1. R. Wiltshire, A Advanced District Heating and Cooling Systems, Woodhead Publishing, 2017
2. Wastewater Engineering, Treatment and Recovery, Fifth edition, Volume 2, Metcalf & Eddy/ Aecom, 2014

Breakdown of average student's workload

	Hours	ECTS
Total workload	60	2,00
Classes requiring direct contact with the teacher	35	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	25	1,00