COURSE DESCRIPTION CARD - SYLLABUS

Course name
Technical building systems (HVAC)

Course

Field of study
Sustainable Building Engineering

Year/Semester
3 / 5

Area of study (specialization)

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes

Other (e.g. online)

Tutorials

Projects/seminars
15

Number of credit points

3

Lecturers

Responsible for the course/lecturer:
Radosław Górzeński, PhD

email: radoslaw.gorzenski@put.poznan.pl

tel. (61) 6653968

Faculty of Environmental Engineering and Energy

ul. Berdychowo 4, 61-118 Poznań

Responsible for the course/lecturer:

Prerequisites

Basic knowledge of mathematics and physics and general knowledge of heat transfer and fluid mechanics, ventilation. Ability to use available sources of information, read technical drawings, as well as to prepare them in a traditional way and with the use of programs supporting design, communication in a foreign language, including knowledge of technical language elements. Understanding of the need to improve professional and personal competences, as well as the ability to set priorities in the implementation of the task specified by him and others.

Course objective

The aim of the course is to acquire basic knowledge and skills in the field of building equipment related

to HVAC installations (heating, ventilation, air conditioning), taking into account modern technical and material solutions related to it, needed to solve typical practical problems occurring in design.

Course-related learning outcomes

Knowledge

1. Know building legislation, Polish standards (PN) and European standards (EN), technical conditions of constructing building facilities and energy-saving buildings.

2. Know the basics of building physics, concerning heat and moisture flows in building components and facilities, energy supply, and the main rules of selecting building installation systems with respect to renewable energy sources.

3. Have basic knowledge of development trends and life cycle as referred to technical fitting of building unit.

4. Have knowledge of thermal comfort and air quality in high-energy standard buildings.

Skills

1. Can classify building facilities and elements of technical fitting of buildings.

2. Using appropriate methods, techniques and to tools, are able to design installations and devices typical for environmental engineering.

3. Are able to perform energy balance when creating the inside comfort of building units.

Social competences

1. Are ready to autonomously complete and broaden knowledge in the field of modern processes and technologies of building engineering.

2. Understand the need of team work, are responsible for the safety of their own work and team's work.

3. Understand the need to transfer to the society the knowledge about sustainable building engineering, transfers the knowledge in a clear and easily comprehensible manner.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The learning outcomes will be verified during a single answer multiple choice test and during work on the design exercise. Obtaining a positive grade, related directly to the design exercise developed by the student, requires compliance with the principles regarding the substantive and graphic content of the study, provided by the teacher at the beginning of the semester.

Lectures - single answer multiple choice test within the deadline given at the beginning of the semester.

Design - the project exercise prepared by students and single answer multiple choice test within the deadline given at the beginning of the semester.

The mark scale used to evaluate student work from lectures and project exercises (percentage of points / mark): 0-50 ndst, 51-60 dst, 61-70 dst +, 71-80 db, 81-90 db +, 91-100 bdb.

Programme content

Lectures

Classification and characteristics of sustainable buildings. Ecological and energy assessment of buildings.

Fundamentals of thermal physics of buildings. Requirements and rules for energy certification of buildings.

The principles of architectural and construction design of energy-saving buildings. Technological and material solutions of building elements. Thermal bridges.

Hygrothermal calculations. Heat losses and gains. Thermal and cooling loads. Energy demand.

Psychrometry of air-conditioning processes (psychrometric chart, basic changes).

Climate comfort (thermal, IAQ and others) and calculation of indoor air parameters.

Gaseous and dust pollution in rooms, Calculation of the necessary amount of air for ventilation according to various criteria.

Climate and calculated outside air parameters.

Technical equipment of buildings. Characteristics of the energy needs of facilities - heating, ventilation and air conditioning, preparation of hot utility water (HVAC).

Classification of HVAC systems.

Building heating systems (phenomena, thermal comfort, heat and flow calculations, system components and their calculation, design principles).

Ventilation systems of objects (physical phenomena causing air flow in buildings, natural, mechanical, hybrid, general, local, industrial ventilation, etc.).

Room air conditioning systems, system components, heat and flow calculations, design principles

Overview of devices and components of HVAC installations.

Sources of heat and cold: traditional and modern, using renewable energy sources (RES).

Ways of saving heat in heating, ventilation and air conditioning (HVAC) installations.

Modern technological and material solutions for sustainable building elements, including those with limited energy demand - practical examples (case study).

Control and measurement methods in heating, ventilation and air-conditioning techniques.

Acoustics in HVAC installations (noise in air-conditioning installations, sound attenuation in elements of air-conditioning installations, sound absorption in rooms).

Automatic regulation and control systems in HVAC systems.

Projects

Hygrothermal calculations for building partitions. Determination of heat losses and gains as well as thermal and cooling loads for the building. Determining energy demand (heat and cold) - calculating the energy performance of a selected building.

Design of a one-channel, multi-zone heating and ventilation system for a selected public building.

Teaching methods

1. Lecture: multimedia slideshow, illustrated with examples on the board.

2. Design classes: exercises using the problem method and design.

Bibliography

Basic

1. Recknagel H., Sprenger E., Schramek E.R.: Kompendium wiedzy: ogrzewnictwo, klimatyzacja, ciepła woda, chłodnictwo, Wydawnictwo Omni Scala, Wrocław 2008

2. Pełech A.: Wentylacja i klimatyzacja - podstawy. Oficyna Wydawnicza Politechniki Wrocławskiej. Wrocław 2008

3. Jones W.P.: Klimatyzacja. ARKADY. Warszawa 2001

4. Principles of Heating Ventilating and Air Conditioning, R. Howell, W. Coad, H. Sauer, Atlanta 2013

5. Handbook of Heating, Ventilation, and Air Conditioning, J. Kreider, Boca Raton 2001

Additional

1. Building Services Design for Energy Efficient Buildings, P. Tymkow, S. Tassou, M. Kolokotroni, H. Jouhara, Abingdon 2013

2. HVAC Fundamentals, Volume 1: Heating Systems, Furnaces and Boilers, J. Brumbaugh, Indianapolis 2004

3. Heating, Cooling, Lighting: Sustainable Design Methods for Architects, N. Lechner, Hoboken 2009

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	45	2,0
Student's own work (literature studies, preparation for tests, project preparation) [1]	30	1,0

[1] delete or add other activities as appropriate