COURSE DESCRIPTION CARD - SYLLABUS

Course name
Thermal Physics of Buildings [S1IŚrod1>FCB]

Course

Field of study
Environmental Engineering

Year/Semester
2/4

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
0

Other (e.g. online)
0

Tutorials
15

Projects/seminars
0

Number of credit points

2,00

Coordinators

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

Lecturers

Prerequisites

Basic knowledge of mathematics, physics. Basic knowledge of subjects: Thermal engineering and Construction and engineering structures. She/he can use the available sources of information. She/he can identify and describe building materials and their basic physical characteristics. She/he can present layers of individual 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 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 the student to acquire theoretical and practical knowledge of the basic concepts and selected issues regarding heat and mass transfer in building partitions along with the assessment of the physical properties of building materials used in buildings.

Course-related learning outcomes

Knowledge:
1. Student has knowledge of the thermal parameters of the internal environment and the characteristics

of the parameters of the external air.
2. Is familiar with commonly used construction and installation materials and their properties.
3. Knows the basic laws of physics regarding heat and mass transfer in a building and in building partitions.
4. Has basic knowledge of how to shape building components in terms of heat and humidity.

Skills:
1. Student can explain: the course of basic thermal phenomena in building components.
2. Can calculate heat transfer coefficients of various building components in contact with air and soil.
3. Can make calculations to avoid condensation on the surface of the building barrier.
4. Can perform calculations of additional thermal insulation necessary to meet the assumed criterion.

Social competences:
1. The student can estimate the impact of modification of building structures on the course of thermal phenomena.
2. Is able to interpret and apply building standards and regulations in the field of thermal and energy issues and is able to qualify whether these requirements are met.
3. Can discuss the thermal properties and energy parameters of building objects.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures:
Passing 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.
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.

Programme content

Lectures:
1. Thermal parameters of the internal environment. External climate factors and their impact on the building's heat balance.
2. Hygrothermal properties of the typical building materials.
3. Simple analysis of steady-state thermal conductivity by the complex elements of the building partitions.
4. Thermal bridges.
5. Basics of moisture exchange in the building.
6. Diffusion and condensation of water vapor in partitions (surface and depth condensation, risk of mold growth).
Tutorials:
1. Calculations of the heat transfer coefficient and temperature distribution in multi-layer building partitions.
2. Determination of the zero isotherm and the felt temperature.
3. Determination of moisture distribution in the building partition.
4. Determining the required thickness of partitions insulation.
5. Calculations of windows’ thermal insulation.

Teaching methods

Lectures:
Informative lecture with elements of a conversational lecture; Multimedia presentation; Exercise elements
Tutorials:
Problem method; Interactive problem solving

Bibliography

Basic:
[1] Andrzej Dylla, Fizyka cieplna budowli w praktyce. Obliczenia cieplno-wilgotnościowe.

Wydawnictwo Naukowe PWN, 2020
[2] Praca zbiorowa pod kier. P .Klemma: Budownictwo ogólne t.2 wyd. Arkady 2005
[3] Płoński, Pogorzelski : Fizyka budowli Arkady 1976
[4] Rozporządzenie Ministra Infrastruktury z 12 kwietnia 2002 w sprawie warunków technicznych, jakim powinny odpowiadać budynki i ich usytuowanie. (z późniejszymi zmianami)

Additional:
[1] Yunus A. Cengel. Heat transfer: A practical approach. International edition. McGRAW-HILL. 2003.
[2] Faye C. McQuiston. Heating, Ventilating, and Air Conditioning. Analysis and design. John Wiley & br/ >Sons, Inc.
[3] Fanger P. O. Thermal Comfort. Analysis and Applications in Environmental Engineering. McGraw-Hill Inc.,US. 1973.
[4] ASHRAE Handbook. Fundamentals. SI Edition

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	1,00