PHYSICS OF BUILDINGS 1

General information	
Subject	Physics of Buildings 1
Faculty	Faculty of Civil Engineering, Architecture and Environmental Engineering
Course of study	Architecture
Profile	General academic
Type of study	I level with the degree of Eng. Arch.
Starting semester	Winter semester

Information about the subject	
Semester	3
Number of ECTS points	3
Subject type	obligatory
Language of instruction	English
Syllabus prepared by	Anna Staszczuk PhD Eng.

Type of class

Course type	*Number of classes per semester (full time studies)*	*Number of classes per week (full time studies)*	*Number of classes per semester (part time studies)*	*Number of classes per week (part time studies)*	*Credit type*
Lecture	15	1	-	-	Exam
Exercise	30	2	-	-	Credit with a grade

Subject objective

1. The objective in terms of knowledge is to familiarize the student with the problems of building design with particular emphasis on thermal and humidity phenomena, acoustics and lighting issues in accordance with the principles of sustainable development in construction.
2. The objective in terms of skills is to teach the student to perform basic calculations related to building physics.
3. The objective in terms of personal and social competences is to prepare the student to present his own solution to a computational problem posed in class and defend it in front of a group of students.

Initial requirements

Formal: Mathematics, Physics, Technical Drawing, Materials Science, General Construction

Subject scope

Lecture: Introduction to building physics. Building and the environment - sustainable development. Interdisciplinary character of building physics. Basics of heat and moisture transfer in building materials and walls. Rules for designing building partitions in terms of thermal characteristics and humidity. Current requirements and trends in the standardization of thermal protection and protection against moisture condensation. Computer programmes for solving thermal and humidity problems. Heat balance in buildings. Thermal bridges and their impact on heat losses from buildings. Energy audit and thermo-modernization of existing residential and public buildings. Comprehensive assessment of the energy performance of buildings. Energy-efficient and passive construction. Rationalization of thermal protection of buildings. Buildings and human health - room microclimate (factors shaping thermal comfort, ventilation and indoor air quality, shell tightness, sick building syndrome). Acoustics - propagation in open spaces, interior acoustics, acoustic insulation of partitions. Basic phenomena concerning daylight and artificial lighting.
Exercise: Calculations of heat and humidity, including: determination of U heat transfer coefficients

for external walls of homogeneous and inhomogeneous materials, determination of temperature distribution in the partition, calculations of surface condensation and inside the partition in accordance with the currently applicable standards in this area. Calculations in the field of acoustics, including: calculating the level of sound intensity, acoustic pressure, determining the acoustic insulation of building partitions and reverberation time

Educational methods
Explanation methods: lectures - conventional, problematic, conversational, informative, lectures. Research methods: exercises - solving computational tasks with the teacher, discussion of results, individual and team work - interactive and creative education

Education results and verification methods

Description	*Symbol*	*Verification method*	*Type of class*
The student can define, recognize and describe the basic physical phenomena occurring in buildings and their elements, including thermal, humidity and acoustic phenomena, and ones related to daylight and artificial lighting. The student can define the basic principles of designing buildings and their elements in terms of the abovementioned problems, based on the current requirements in this area (standards, regulations, etc.)	K_W01	– exam - test with points	Lecture
The student can individually solve computational tasks in the field of building physics, defined in the exercise syllabus	K_U06 K_U08	– test with points	Exercise
The student is aware of the importance and need for lifelong education and improving their qualifications	K_K01	– observation and evaluation of participation in the classes	Lecture
The student knows that it is necessary be active, creative, determined, and open to the ideas of other people. The student can work individually and in a team.	K_K02	– observation and evaluation of participation in the classes, – observation and evaluation of the student's practical skills	Exercise

Requirements to obtain a credit
Lecture: The student takes the exam. Exercise: The student obtains positive grades for all partial tests, attends classes and is active in class. The rules of determining the grade: The grade for the lecture includes the grade for the examination test. The grade for the exercises includes the grade for the partial tests, the grade for attendance and the grade for participation and it is the arithmetic mean of these grades. Scores: 50-60% - satisfactory 61-70% - satisfactory plus 71-80% - good 81-90% - good plus 91-100% - very good. The final grade for the subject is the arithmetic mean of the grades for the lecture and the exercises.

Student's work

Student's work	*Full time study (h)*
Interaction with the teacher (classes; consultations; exam, etc.)	50
Student's individual work (preparation for the classes, test exam;	25

literature research preparation of: written paper, project, presentation, report, speech; etc.)	
Total	75
ECTS points	*Full time study*
Work with a teacher	2
Work without a teacher	1
Total	3

Basic literature

1. Bąk J., Pabjańczyk W., Podstawy techniki świetlnej, Nakład Politechniki Łódzkiej, Łódź 1994.
2. Dean Heerwagen, *Passive and Active Environmental Controls. Informing the schematic designing of buildings*, The McGraw-Hill Companies, Inc. 2004.
3. Furmański P., Domański R., Wymiana ciepła, Przykłady obliczeń i zadania, Politechnika Warszawska, Warszawa 2002.
4. Hauser J., Elektrotechnika. Podstawy elektrotermii i techniki świetlnej, Wydawnictwo Politechniki Poznańskiej, Poznań 2006.
5. Hugo Hens, *Building Physics - Heat, Air and Moisture: Fundamentals and Engineering Methods with Examples and Exercises*, 3rd Edition, Wiley, Ernst & Sohn, 2017.
6. Klemm P. (red.), Fizyka budowli, Tom 2, Arkady, Warszawa 2005.
7. Kubik J., Przepływy wilgoci w materiałach budowlanych, Polit. Opolska, Opole 2000.
8. Laskowski L., Ochrona cieplna i charakterystyka energetyczna budynku, Politechnika Warszawska, Warszawa 2008.
9. Pinteric Marko, *Building Physics. From Physical Principles to International Standards*, Springer International Publishing AG, 2017.
10. Pogorzelski J. A., Fizyka budowli dla architektów (cykl artykułów publikowanych od czerwca 2004 r. do października 2005 r.) w „Materiałach budowlanych".
11. Pogorzelski J. A., Katalog mostków cieplnych, ITB, Warszawa 2003.
12. Sadowski J., Akustyka architektoniczna, PWN, Warszawa 1976.
13. Steven V Szokolay, *Introduction to Architectural Science: The Basis of Sustainable Design*, Elsevier, Architectural Press, 2004.
14. Wyrwał J., Termodynamiczne podstawy fizyki budowli, Politechnika Opolska, Opole 2004.
15. Zakrzewski T., Żuchowski R., Kompendium akustyki architektonicznej wraz z przy-kładami metod obliczeniowych, Wydawnictwo Politechniki Śląskiej, Gliwice 2009.
16. Żagan W., Podstawy techniki świetlnej, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2005.

Aktualnie obowiązujące normy i rozporządzenia podane na zajęciach przez prowadzącego.

Complementary literature

1. Monthly „Izolacje".
2. Monthly „Materiały budowlane".

Notes