STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Physics of Buildings**		Code **1010101131010100025**
Field of study **Sustainable Building Engineering First-cycle**	Profile of study (general academic, practical) **general academic**	Year /Semester **2 / 3**
Elective path/specialty **-**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **First-cycle studies**	Form of study (full-time,part-time) **full-time**	
No. of hours Lecture: **30** Classes: **15** Laboratory: **-** Project/seminars: **-**		No. of credits **3**
Status of the course in the study program (Basic, major, other) **other**	(university-wide, from another field) **university-wide**	
Education areas and fields of science and art **technical sciences** **Technical sciences**		ECTS distribution (number and %) **3 100%** **3 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	basic knowledge of mathematics, physics basic knowledge of Building Construction and Building Materials
2	**Skills**	use the available sources of information identify and describe building materials and their basic physical characteristics can present layers of individual building partitions
3	**Social competencies**	awareness of the need to constantly update and supplement building knowledge and engineering skills he can work on a task independently and collaborate in a team

Assumptions and objectives of the course:

Acquisition by the student of theoretical and practical knowledge of basic concepts and selected issues that are necessary for the proper design and construction of buildings ? heat and mass exchange in building partitions and energy balance of residential buildings

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. He/she is familiar with commonly used construction and installation materials and their properties - [W01,KSB_W14]
2. He/she knows basics of construction physics in terms of heat and humidity migration in building components and in construction works - [W02,KSB_W13]
3. He/she has basic knowledge in the area of formation of building components in terms of thermal performance, humidity - [W03,KSB_W05]
4. He/she has knowledge in areas of acoustics - [W04 ,KSB_W01]

Skills:

1. He/she can define the basic concepts of heat transfer and energy balance of a building - [U01, KSB_U01]
2. He/she can explain: the course of basic thermal phenomena in building components - [U02, KSB_U03]
3. He/she can calculate the basic thermal and energy characteristics necessary for the design of buildings partitions and buildings - [U03, KSB_U14]
4. He/she can make calculations to avoid condensation on the surface of the building barrier - [U04,KSB_U03]

Social competencies:

1. He/she can estimate the impact of modification of building structures on the course of thermal phenomena - [K01,KSB_K01]
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 - [K02, KSB_K02]
3. He/she can discuss the thermal properties and energy parameters of building objects - [K03, KSB_K02]

Assessment methods of study outcomes

Lecture:

Exam in an exam session. 5 open questions rated on a scale of 10 points each.

Rating: 51- 60% ? 3,0 61- 70% ? 3,5 71- 80% ? 4,0 81- 90% ? 4,5 91-100% ? 5,0

Tutorials:

Final test in the last class. 3 open tasks rated on a scale of 10 points each.

Rating: 51- 60% ? 3,0 61- 70% ? 3,5 71- 80% ? 4,0 81- 90% ? 4,5 91-100% ? 5,0

Course description

Lecture:

? Basic terms of thermal physics of the building.
? Thermal conductivity in the building materials. Fourier law. Convection. Radiation
? Hygrothermal properties of the typical building materials
? Steady-state thermal conductivity through the multi-layer building partitions. Thermal resistance and heat transfer coefficient
? Simple analysis of steady-state thermal conductivity by the complex elements of the building partitions
? Thermal comfort. Characteristic of climate of Poland
? Internal microclimate. The conditions in the premises during winter or summer
? Transparent partitions ? selective gain of solar radiation energy
? Basics of moisture exchange in the building.
? Requirements regarding the thermal protection of the buildings. Rules of the building partitions designing
? Thermal bridges
? Thermovision - detection of thermal defects in the building envelope.
? Building acoustics (acoustic parameters of the interior, parameters of the acoustic quality evaluation of the room)

Tutorials:

? Calculation of thermal insulation and temperature distribution in multilayer building partitions: wall, roof and ground floor
? Determining the required thickness of partitions insulation
? Calculations of thermal insulation of windows
? Calculations of the fRsi coefficient of the external partitions
? Final test

Informative lecture with seminar elements, lecture with multimedia presentation
Tutorials- exercise method

Basic bibliography:

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 & 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.

Additional bibliography:

1. Neufert. Podręcznik projektowania architektoniczno-budowlanego. Wyd. Arkady. 2011.
2. Praca zbiorowa pod kier. P .Klemma. Budownictwo ogólne. Tom 2. Wyd. Arkady. 2005.
3. Płoński, Pogorzelski. Fizyka budowli. Arkady. 1976.
4. Laskowski L. Ochrona cieplna i charakterystyka energetyczna budynku. Oficyna Wydawnicza Politechniki Warszawskiej. Warszawa. 2005.
5. Aktualne normy.

Result of average student's workload

Activity	Time (working hours)

1. Participation in lectures (contact hours) 2. Participation in tutorials (contact hours, practical hours) 3. Participation in duty hours related to the implementation of the project, laboratory, tutorials (we assume that the student uses 1 consultation) (contact hours) 4. Preparation for the final test of the tutorials (independent work) 5. Preparation for the exam (independent work) 6. Attendance at an exam (contact hours)	30 15 1 15 25 2

Student's workload

Source of workload	hours	ECTS
Total workload	88	3
Contact hours	48	2
Practical activities	15	0