

## COURSE DESCRIPTION CARD

Faculty of Civil Engineering and Environmental Sciences										
Field of study								Degree level and programme type		
Specialization/ diploma path								Study profile	Academic profile	
Course name	Thermal diagnostics of buildings and thermomodernization							Course code	IS-FCEE-00115-1W	
								Course type	Erasmus	
Forms and number of hours of tuition	L	C	LC	P	SW	FW	S	Semester	winter	
	30			30				No. of ECTS credits	4	
Entry requirements	Physics II - basics of building physics, Building physics, Basics of thermal diagnostics of buildings									
Course objectives	<p>To broaden student's knowledge about methods used in thermal diagnostics of buildings (thermal insulation of partitions, heat consumption for space heating and hot water preparation). To familiarize students with the possibilities of rationalizing the use of energy through thermomodernization (building envelope and central heating, domestic hot water and ventilation installations). To familiarize students with the possibilities of using modern measurement methods in thermal diagnostics of buildings (thermovision inspection, assessment of the thermal quality of external partitions - HFM, airtightness test - indicator n50). To broaden student's knowledge about the possibility of using renewable energy sources for heating and hot water preparation. Providing knowledge about the dependences between the thermal characteristics of a building and comfort of use as well as costs of use and environmental load.</p>									
Course content	<p><u>Lecture:</u> Thermomodernization - principles of planning and carrying out investments. Components of the heat balance of buildings. Heat demand for space heating. Analysis of the energy state of buildings based on EU, EK and EP indicators. Optimal thermal insulation thickness; economic efficiency of heat sources. Possibilities of co-financing thermo-modernization investments and their economic efficiency. Thermal comfort of rooms and rationalization of energy use. Methods of thermal diagnostics of buildings (tightness test by the "blower door" method, thermal imaging diagnostics, assessment of the quality of external partitions by the HFM method) in the aspect of determining their energy performance and during the acceptance of thermo-modernization works and new buildings. Modernization of heating and ventilation installations in terms of improving the energy performance and thermal comfort of the building. Modernization of heat sources using unconventional and renewable energy sources.</p> <p><u>Project:</u> Determining the energy performance of a building and installation. Determining the optimal thickness of thermal insulation; economic efficiency of heat sources - an example.</p>									

<b>Teaching methods</b>	informative and problem lecture, project classes	
<b>Assessment method</b>	lecture - written exam, project - corrections, defense, presentation and discussion	
<b>Symbol of learning outcome</b>	<b>Learning outcomes</b>	<b>Reference to the learning outcomes for the field of study</b>
<b>L01</b>	Student knows the rules of selection of effective heat sources and optimal thickness of thermal insulation of partitions and determination of indicators describing the energy performance of a building with its installations and heat source.	K_B2_W07 K_B2_W06
<b>L02</b>	Student knows the dependences between the thermal comfort of rooms and the energy performance of the building.	K_B2_W07
<b>L03</b>	Student understands the role of measurements in thermal diagnostics of buildings and acceptance of thermo-renovation works.	K_B2_W05
<b>L04</b>	Student is able to use the indicators of useful, final and primary energy for a detailed assessment of the building and its installation in terms of energy, is able to use selected computer programs supporting this assessment and is able to critically assess its results.	K_B2_U01 K_B2_U02 K_B2_U07 K_B2_U08
<b>L05</b>	Student can determine the optimal thickness of the thermal insulation of the building partitions.	K_B2_U01
<b>L06</b>	Student understands the interaction between the activities of the designer and contractor and the energy quality of the building.	K_B2_K01 K_B2_K02
<b>Symbol of learning outcome</b>	<b>Methods of assessing the learning outcomes</b>	<b>Type of tuition during which the outcome is assessed</b>
<b>L01</b>	written exam (multiple choice test), project corrections, defense and discussion of the project	L, P
<b>L02</b>	written exam (multiple choice test),	L
<b>L03</b>	written exam (multiple choice test),	L
<b>L04</b>	written exam (multiple choice test), project corrections, defense and discussion of the project	L, P
<b>L05</b>	project corrections, defense and discussion of the project	P
<b>L06</b>	written exam (multiple choice test), project corrections, defense and discussion of the project	L, P
<b>Student workload (in hours)</b>		<b>No. of hours</b>
<b>Calculation</b>	lecture attendance	30
	participation in classes	30
	performing design tasks at home	15
	participation in student-teacher sessions related to the classes/project	2
	preparation for the exam / test and attendance	20

	preparation to the project classes	10
	<b>TOTAL:</b>	<b>107</b>
<b>Quantitative indicators</b>		<b>HOURS</b>
<b>Student workload – activities that require direct teacher participation</b>		<b>2</b>
<b>Student workload – practical activities</b>		<b>2</b>
<b>Basic references</b>	<p>1. <i>Technical requirements for buildings</i> (<a href="https://epbd-ca.eu/ca-outcomes/outcomes-2015-2018">https://epbd-ca.eu/ca-outcomes/outcomes-2015-2018</a>)</p> <p>2. Grudzińska M. Ostańska A., Życzyńska A. "Low Energy and Passive Buildings". Medium. Warsaw, 2017</p> <p>3. <i>Buildings 2020+ Construction, materials and installations</i>, Editor Krawczyk D.A., Białystok – Cordoba – Vilnius 2019 (<a href="https://pb.edu.pl/oficyna-wydawnicza/wp-content/uploads/sites/4/2018/12/Buildings-2020-part1-20.12.pdf">https://pb.edu.pl/oficyna-wydawnicza/wp-content/uploads/sites/4/2018/12/Buildings-2020-part1-20.12.pdf</a>)</p> <p>4. <i>Buildings 2020+ Energy sources</i>, Editor Krawczyk D.A., Białystok – Cordoba – Vilnius 2019, (<a href="http://www.vipskills.pb.edu.pl/images/download/Buildings-2020-part2-04-02-2019.pdf">http://www.vipskills.pb.edu.pl/images/download/Buildings-2020-part2-04-02-2019.pdf</a>)</p>	
<b>Supplementary references</b>	<p>1. Markiewicz-Zahorski Przemysław, "Building construction, solution &amp; details for professionals", Polygraphy Department of the Cracow University of Technology, 2019</p> <p>2. National standards: EN ISO 10456; EN ISO 6946; EN ISO 13788; PN-EN ISO 7730</p>	
<b>Organisational unit conducting the course</b>	<b>Department of Energy-Efficient Construction and Geodesy</b>	<b>Date of issuing the programme</b>
<b>Author of the programme</b>	<b>Beata Sadowska, PhD, Eng.</b> <b>Wiesław Sarosiek, PhD, Eng.</b> <b>Robert Stachniewicz, PhD, Eng.</b>	<b>10.01.2020</b>

L – lecture, C – classes, LC – laboratory classes, P – project, SW – specialization workshop, FW - field work,

S – seminar