

**COURSE DESCRIPTION CARD – MODULE 3**

<b>Field of study</b>	International Interdisciplinary Summer School "Energy-efficient construction, users and environment friendly"					<b>Programme type</b>	Summer course
<b>Module name</b>	Energy saving heating and ventilation systems and the thermal comfort of the user					<b>Course code</b>	IISS2026-M3
						<b>Course type</b>	obligatory
<b>Forms and number of hours of tuition</b>	<b>L</b>	<b>LC</b>	<b>P</b>	<b>SW</b>	<b>FW</b>	<b>Language</b>	English
	2			12			
<b>Course objectives</b>	Ability to select the optimal heating, ventilation, and air-conditioning system for different types of buildings. Ability to design a heating installation in a residential building while ensuring the highest level of thermal comfort. Ability to analyse and choose optimal solutions depending on climatic conditions, user requirements, and applicable regulations						
<b>Course content</b>	<p><b>Thermal Comfort and Indoor Air Quality</b></p> <ul style="list-style-type: none"> <li>• Discussion of the basic parameters affecting thermal comfort.</li> <li>• Factors determining indoor air quality (IAQ).</li> </ul> <p><b>Heating, Ventilation and Air Conditioning Systems (HVAC)</b></p> <ul style="list-style-type: none"> <li>• Overview of typical heating, ventilation, and air-conditioning systems.</li> <li>• Types and operating principles of heat recovery systems in mechanical ventilation.</li> <li>• Advantages and disadvantages of underfloor heating.</li> </ul> <p><b>Introduction to Audytor SET EN Software</b></p> <ul style="list-style-type: none"> <li>• Overview of the basic functions of the software.</li> <li>• Importing the structural plan of a typical single-family building.</li> <li>• Entering data related to the design of a central heating installation.</li> </ul> <p><b>Design of Heating Installations – Using Convective Radiators and/or Underfloor Heating</b></p> <ul style="list-style-type: none"> <li>• Structure and components of a typical underfloor heating loop.</li> <li>• Designing a default type of heating system (underfloor heating or convective radiators), in both manifold and tee (branch) configurations.</li> <li>• Determining the location of the heat source and manifolds.</li> <li>• Layout of pipes and location of heating loops.</li> <li>• Adding labels and installation elements.</li> <li>• Performing hydraulic calculations and analysing results.</li> </ul> <p><b>Building Ventilation and Air-Conditioning Systems</b></p> <ul style="list-style-type: none"> <li>• Selection of the optimal ventilation/air-conditioning system.</li> <li>• Analysis of the impact of ventilation/air-conditioning on energy consumption and user comfort.</li> </ul> <p><b>Sustainable and Low-Carbon Construction</b></p> <ul style="list-style-type: none"> <li>• Methods of reducing the energy demand of buildings.</li> <li>• Basic energy performance indicators: EU, EK, EP.</li> <li>• Decarbonisation of the building sector.</li> </ul>						



	<ul style="list-style-type: none"> <li>Zero-emission buildings and low-energy building standards.</li> </ul> <p><b>Summary</b></p> <ul style="list-style-type: none"> <li>Preparation of the final report.</li> <li>Discussion on the popularity and availability of solutions in selected countries.</li> <li>Final test.</li> </ul>	
<b>Teaching methods</b>	Lecture, workshop, design work	
<b>Assessment method</b>	Design work defence, evaluation of final report and test	
<b>Symbol of learning outcome</b>	<b>Learning outcomes</b>	<b>Reference to the learning outcomes for the field of study</b>
L01	The graduate knows and deeply understands the construction, principles of operation of modern devices used in heating, ventilation and air conditioning systems.	K_IISS_W02
L02	The graduate knows and understands selected issues in the field of detailed knowledge - necessary to understand the thermal, flow, cooling, ventilation and air conditioning processes occurring in environmental engineering	K_IISS_W04
L03	The graduate knows and has an in-depth understanding of the latest development trends and technologies in environmental engineering.	K_IISS_W05
L04	The graduate knows basic methods of analysis and modeling of thermal-flow processes in buildings	K_IISS_W09
L05	The graduate are able to use acquired knowledge for critical analysis, synthesis, creative interpretation and presentation of issues in the field of environmental engineering and sustainable construction	K_IISS_U02
L06	The graduate are able to properly select the technical conditions for designing buildings in relation to climatic conditions in order to design selected building elements of the facility	K_IISS_U06
L07	The graduate is ready to analyze the content obtained from various sources, as well as to critically evaluate it and use it in professional work	K_IISS_K01
<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>
L01	Defence of the completed project, test and final report.	L, SW
L02	Defence of the completed project, test and final report.	L, SW
L03	Defence of the completed project, test and final report.	L, SW
L04	Defence of the completed project.	SW
L05	Defence of the completed project.	SW
L06	Defence of the completed project.	SW
L07	Defence of the completed project, test and final report.	SW
<b>Student workload (in hours)</b>		<b>No. of hours</b>

<b>Calculation</b>	Participation in the lecture.	2	
	Participation in workshop.	12	
	Preparation of the design and final report.	5	
	Preparation final test.	3	
	Consultation.	2	
	<b>TOTAL:</b>	24	
<b>Quantitative indicators</b>		<b>HOURS</b>	<b>No. of ECTS credits</b>
<b>Student workload – activities that require direct teacher participation</b>		16	0,64
<b>Student workload – practical activities</b>		20	0,80
<b>Basic references</b>	<p>ASHRAE Handbook -- HVAC Systems and Equipment (ASHRAE Handbook of Heating, Ventilating and Air-Conditioning Systems and Equipment SI). Ashrae, 2020.</p> <p>Roger Haines, Michael Myers. HVAC Systems Design Handbook. McGraw Hill; 5th edition, 2009.</p> <p>Carter Grayson. Basic hydronic heating components and their role in a system: Central heating structures possess a larger heating ability than a house heater. They switch the warmth the usage of water or air. Independently published, 2021</p> <p>Roy Treloar. Master Basic Plumbing And Central Heating. Teach Yourself Books, 2017</p> <p>John Sands. Underfloor Heating Systems: An Assessment Standard for Installations Paperback. BSRIA Ltd, 2001.</p> <p>Krawczyk Dorota (red.), Sustainable buildings : designing and management of cost-effective and eco-friendly systems 2022, Oficyna Wydawnicza Politechniki Białostockiej, 211 s., ISBN 978-83-67185-28-8. DOI:10.24427/978-83-67185-29-5</p> <p>Krawczyk Dorota (red.), Sustainable buildings : development of low energy and eco-friendly constructions 2022, Oficyna Wydawnicza Politechniki Białostockiej, 235 s., ISBN 978-83-67185-23-3. DOI:10.24427/978-83-67185-24-0</p> <p>Krawczyk Dorota (red.), Buildings 2020+ : Constructions, materials and installations 2019, Białystok, Oficyna Wydawnicza Politechniki Białostockiej, 249 s., ISBN 978-83-65596-70-3. DOI:10.24427/978-83-65596-71-0</p> <p>Krawczyk Dorota (red.), Buildings 2020+ : Energy sources 2019, Białystok, Oficyna Wydawnicza Politechniki Białostockiej, 274 s., ISBN 978-83-65596-72-7. DOI:10.24427/978-83-65596-73-4</p>		
<b>Organisational unit conducting the course</b>	Department of Sustainable Construction and Building Systems	<b>Date of issuing the programme</b>	
<b>Author of the programme</b>	prof. Dorota Anna Krawczyk	2.12.2025	

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



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