Attachment no. 5 to ZW 16/2020

Attachment no. **43** to studies program

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| **FACULTY OF ARCHITECTURE**  **COURSE SYLLABUS**  Course title in Polish: **Fizyka (akustyka)**  Course title in English: **Physics (acoustics)**  Specialization (if applicable): **Architecture**  Profile (if applicable): **Architecture and Urban Design**  Level and form of studies: **2nd level, full-time**  Semester: **2**  Course type: **obligatory**  Course code: **AUA117714W**  Group of courses: **NO** |

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|  | **Lecture** | **Tutorial** | **Laboratory** | **Project** | **Seminar** |
| Number of hours of organized classes in University (ZZU) | **15** |  |  |  |  |
| Number of hours of total student workload (CNPS) | **30** |  |  |  |  |
| Form of crediting | **Crediting with grade** |  |  |  |  |
| For group of courses mark (X) final course |  |  |  |  |  |
| Number of ECTS points | **1** |  |  |  |  |
| including number of ECTS points for practical (P) classes |  |  |  |  |  |
| including number of ECTS points for direct teacher-student contact classes or other people conducting classes (BU) | **0,8** |  |  |  |  |

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| **PREREQUISITES RELATED TO KNOWLEDGE, COMPETENCES AND SOCIAL SKILLS** |
| **No prerequisites.** |

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| **COURSE OBJECTIVES** |
| **C1** presentation of basic knowledge of aerodynamics aimed at understanding the air masses movement conditions in urbanized areas.  **C2** providing students with the necessary knowledge of building acoustics (including definitions) to understand physical phenomena occurring in the building and its elements related to the propagation of acoustic waves in air and solid materials.  **C3** familiarizing students with the principles of designing building partitions in residential and public utility buildings in terms of acoustics, aimed at ensuring proper acoustic comfort of rooms of various purposes, including familiarization with the binding legal documents and international and national standards.  **C4** providing students with knowledge in the field of users' protection against reverberant noise, including proper selection of finishing materials in buildings: health protection, education and public utility - also open-type offices (considering other parameters of use safety and fire protection). |

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| **COURSE LEARNING OUTCOMES** |
| **Relating to knowledge:**  B.W5. The graduate knows and understands advanced issues of construction, technology and building services engineering, structures and physics of buildings, including key complex issues in architectural and urban design and spatial planning.  B.W6. The graduate knows and understands technical and building regulations.  **Relating to competences:**  B.U7. The graduate is able to properly apply professional and ethical standards and rules as well as legal provisions in the field of architectural and urban design and spatial planning.  **Relating to social skills:** |

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| **PROGRAMME CONTENT** | | |
| **Form of classes - lectures** | | **Number of hours** |
| Lec 1 | Architectural and urban aerodynamics: general information on the properties of fluids, physical quantities describing the movement of air masses. Criteria numbers. Equations of incompressible fluid motion. | 2 |
| Lec 2 | The impact of moving air masses on buildings. Prandtl assumptions for the equations of fluid motion near an obstacle. The concept of a boundary layer. Types of boundary layers. The resistance force. The influence of the resistance force on buildings. | 2 |
| Lec 3 | Modelling of similar phenomena. Geometric and dynamic similarity of flows. Visualization of fluid flows. Vortex structures generated in viscous flows for various Reynolds number intervals. | 2 |
| Lec 4 | Introduction to the course – content and purpose, literature, crediting. Basic information about sound, laws, definitions, units, propagation of acoustic waves in air and materials, types of waves. Environmental hazards due to noise and vibrations. Objectives and tasks of building acoustics. Impact of noise on people. The relationship of acoustics and architecture – analysis – flipped classroom. | 2 |
| Lec 5 | Relationship of acoustics and architecture – analysis – flipped classroom – answers. Basics of acoustic protection of buildings. Methods of implementing sound protection in buildings – designing transparent and non-transparent building partitions. Standard requirements – law, international and national standards and recommendations (ISO and PKN standards). Acoustic insulation of building partitions against airborne and impact sounds. | 2 |
| Lec 6 | Principles of designing building partitions in terms of acoustics. Acoustic insulation of light and massive walls. Acoustic insulation of ceilings. Floating floors. Acoustic insulation of windows and doors, tightness of the building and interiors – analysis of correct solutions and frequently made mistakes. | 2 |
| Lec 7 | Protection against reverberation noise in interiors, including teaching and education buildings, health care and public utility buildings, including open space offices. | 2 |
| Lec 8 | Final test. | 1 |
|  | **Total hours** | **15** |

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| **TEACHING TOOLS** |
| **N1** - Informative lecture.  **N2** - Problem lecture.  **N3** - Multimedia presentation.  **N4** - Quiz and partial knowledge assessment.  **N5** - Moderated discussion using on-line tools.  **N6 -** Flipped classroom with problem solving. |

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| **ASSESSMENT OF ACHIEVEMENT OF LEARNING OUTCOMES** | | |
| **Evaluation** (F – forming (during semester), C – concluding (at semester end) | Number of learning outcome | Method of assessing the achievement of learning outcome |
| F1 | B.W5.  B.W6.  B.U7. | Written test – aerodynamics |
| F2 | Written test – acoustics |
| **C = 50%F1 + 50%F2** | | |

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| **BASIC AND ADDITIONAL LITERATURE** |
| **basic LITERATURE:**   1. Ahnert W., Steffen F. Sound reinforcement engineering: fundamentals and practice, London 1999. 2. ArAc-Multibook – International Partnership ArAc-Multibook, 2015, www.arac-multibook.com. 3. Barron M., Auditorium Acoustics and Architectural Design, London 1993. 4. Boulet M.-L., Moissinac Ch., Soulignac F. Auditoriums, Editions du Monitour, Paris 1990. 5. Breton G. Theater, Paris 1990. 6. Carnegy P., Wagner and the Art of the Theatre: The Operas in Stage Performance, New Haven and London 2006. 7. Cavanaugh W. J., Wilkes J. A. Architectural acoustics: principles and practice, New York 1999. 8. Jordan V., L. Acoustical Design of Concert Halls and Theatres. A personal Account, London 1980. 9. Lord P., Templeton D. The Architecture of Sound. Design Places of Assembly, London 1986.Steele J. Theatre builders, Chichester 1996. 10. Chung Fang, Introduction to Fluid Mechanics, Springer International Publishing, London, 2019, ISBN: 3319918206. 11. Morrison, F. A., An Introduction to Fluid Mechanics, Cambridge University Press, Cambridge, 2011, ISBN: 9781107003538.   **additional LITERATURE:**   1. The architectural platforms, i.e.: ArchDaily | Broadcasting Architecture Worldwide, Dezeen | architecture and design magazine. 2. Bradley J., S., Madaras G., Jaffe Ch. Acoustical characteristics of a 360-degree surround hall, „The Journal of the Acoustical Society of America”, 1997, no 5 (101), s. 3135. 3. Cavanaugh W., J., Wilkes J., A. Architectural acoustics: principles and practice, New York 1999. 4. Springer handbook of acoustics, red. Rossing Th. D., New York 2007. 5. Wisniewski E., Die Berliner Philharmonie und Ihr Kammermusiksaal. Der Konzertsaal als Zentralraum, Berlin 1993. 6. Cengel Y. A., Fluid Mechanics: Fundamentals and Applications, McGraw-Hill Education, London, 2018, ISBN13 (EAN): 9781259921902. 7. White, F. M., Fluid mechanics, Mcgraw-Hill series in mechanical engineering, New York, 2020, ISBN-13: 978-0073398273. |

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| **COURSE SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)** |
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