COURSE DESCRIPTION CARD - SYLLABUS

Course name
Architectural design - acoustics [S1Arch1>PAA]

Course

Field of study
Architecture

Year/Semester
2/3

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
0

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
15

Number of credit points

1,00

Coordinators

Lecturers

Prerequisites

1 Knowledge: • basic knowledge of physics at high school level • basic knowledge of architectural and urban design • basic knowledge of the history of architecture 2. Skills: • the student is able to obtain information from literature, databases and other, properly selected sources, can integrate information, interpret it, as well as draw conclusions and formulate and justify opinions 3. Social competences • the student understands the need for lifelong learning, • the student understands the need to expand competences,

Course objective

• Acquiring the ability to design acoustic interiors with so called non-qualified acoustics in accordance with the requirements of the obligatory standard PN-B-02151-4 - Building Acoustics - Protection against Noise in Buildings (Polish standard) • Getting to know acoustic materials on the basis of material samples and catalogs of acoustic products. • Acquiring the ability to calculate the acoustic absorption for a selected room of so called non-qualified acoustics • Acquiring the ability to calculate the RT reverberation time using the Sabin formula and the Eyring formula • Acquiring basic design skills in the CattAcoustic program - design of a classroom or sports Hall

Course-related learning outcomes

Knowledge

Student knows and understands:
A.W1. architectural design for the implementation of simple tasks, in particular: simple facilities taking into account the basic needs of users, single- and multi-family housing, service facilities in residential complexes, public facilities in an open landscape or in an urban environment;
A.W2. urban design in the scope of implementation of simple tasks, in particular: small building complexes, local spatial development plans, taking into account local conditions and connections, as well as forecasting transformation processes in the settlement structure of towns and villages;
A.W4. principles of universal design, including the idea of designing spaces and buildings accessible to all users, in particular for people with disabilities, in architecture, urban planning and spatial planning, and ergonomic principles, including ergonomic parameters necessary to ensure full functionality of the designed space and facilities for all users, especially for people with disabilities

Skills
Student can:
A.U1. design an architectural object by creating and transforming space so as to give it new value - in accordance with a given program that takes into account the requirements and needs of all users;
A.U4. make a critical analysis of the conditions, including the valorization of the land development and building conditions;
A.U5. think and act creatively, using the workshop skills necessary to maintain and expand the ability to implement artistic concepts in architectural and urban design;
A.U6. integrate information obtained from various sources, formulate their interpretation and critical analysis;
A.U7. communicate using various techniques and tools in a professional environment appropriate for architectural and urban design;
A.U8. prepare architectural and construction documentation in appropriate scales in relation to the conceptual architectural design;

Social competences
Student is capable of:
A.S1. independent thinking to solve simple design problems;
A.S2. taking responsibility for shaping the natural environment and cultural landscape, including the preservation of the heritage of the region, country and Europe.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The basis for credit is to pass the test and prepare the board.
Formative assessment:
- Assessment of involvement in design and calculation works
- Evaluation of the effectiveness of design activities leading to obtaining an interior compliant with the requirements of PN-B-02151-4 - Building Acoustics - Protection against Noise in Buildings
- Attendance
- Final design board - prepareed individually by each student - evaluation of the quality of the boards and design solutions
Summative assessment -
The grade obtained from the test, the project board, and class attendance
The test checks the ability to calculate the reverberation time of a given interior.
Project board, individually prepared by each student, developed in accordance with the guidelines, format 50 × 70 cm. The board should include: - description - the description should briefly describe the function of the room and the design problem, provide the guidelines from the PN-B-02151-4 standard "Building acoustics - Protection against noise in buildings" for the designed function and volume of the room, the reverberation time RT before and after the application of acoustic corrections, along with specification of material solutions. - a modeled room from the Sketchup program, a scale showing the scale of the room, a cross-section and a projection showing dimensions and scale or scale should be provided. - comparative graph of the reverberation time RT in the frequency function, for the considered cases. - table - the value of the sound absorption coefficient α for octave bands should be given in the form of a table for all used finishing materials. – view (plan) of the room with the sound source and the distribution of the STI parameter at the measurement points under consideration
Assessment scale: 2,0; 3.0; 3.5; 4.0; 4.5; 5.0

Programme content

1. Introduction to the subject, discussion of the current issues. Standard PN-B-02151-4 "Building acoustics - Protection against noise in buildings", calculation of acoustic absorption, introduction to calculations with usage of acoustic absorption calculators.
2. Acoustic materials and their properties. Getting acquainted with material samples from the library of materials of the Acoustic Laboratory. Creating a catalog of acoustic materials and selecting three acoustic materials for the ceiling, walls and floor, which will later be used in the project. Evaluation of the best material solution.
3. Getting to know the methods of calculating the reverberation time. Calculation of the reverberation time according to the Sabin formula. Review of reverberation time calculators available on the Internet - practical exercises.
4. Determining the dimensions of the classroom for the implementation of the acoustic design
- drawing a model of the room in SketchUp
- calculation of the reverberation time of the selected room model
- loading the model into the CattAcoustic program
5. Model verification in the CattAcoustic program. Rooms with so called non-qualified acoustics - scope of the design study.
6. Simulation in CattAcoustic.
7. Assessment of the acoustic functionality of the finishing materials used and the correctness of the obtained results in relation to the standard requirements.

Teaching methods

1. Design
2. Case study
3. eLearning Moodle
4. Working in groups
5. Discussion
6. Computer programs

Bibliography

Basic:
1. Egan D., Architectural acoustics, J. Ross Publishing, 2007
2. Ermann, M., Architectural Acoustics Illustrated. Wiley 2015
3. PN-B-02151-4 - Building Acoustics - Protection against Noise in Buildings (Polish standard)

Additional:
1. Beranek L. Concert Halls and Opera Houses: Music, Acoustics and Architecture. Springer 2004, Second Edition Newhouse Victoria. Site and Sound, Monacelli Press 2012
2. Dalenbäck, B-I.L., CATT-Acoustic v9.1, User's Manual, CATT, Gothenburg, Sweden (2016).
3. Sygulska A., "Acoustic study of two modern churches", Vibrations in Physical Systems, vol. 25, Poznań 2012, s. 381-386.
4. Sygulska A., Czerniak T., Czarny-Kropiwnicki A., "Experimental investigations and computer simulations to solve acoustic problems in the modern church" Engineering Structures and Technologies, Taylor & Francis 10(1), 2018, pp. 34-45.

Breakdown of average student's workload

	Hours	ECTS
Total workload	25	1,00
Classes requiring direct contact with the teacher	15	0,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	10	0,50