COURSE DESCRIPTION CARD - SYLLABUS

Course name
Parametric Design of Architecture [S1Arch1E>PPA]

Course

Field of study
Architecture

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
0

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

– the student has basic knowledge about the rules of safe use of computer equipment – the student has basic knowledge about graphics software – the student can obtain information from literature, databases, and properly selected sources, integrate information, interpret it, and draw conclusions, as well as form and justify opinions – the student can use computer equipment – the student can correctly identify and solve dilemmas related to the practice of the profession

Course objective

• The aim of the course is to provide the basics of current knowledge: theoretical and practical in the field of computer-aided design in the field of advanced, multi-faceted algorithmic building modeling. • As part of the course, the basics of knowledge about computer-aided design in the context of an architectural workshop are presented. During the classes, specific practical tasks are performed to acquire knowledge specific to the discussed topic regarding the modern IT workplace. The introduction to their implementation are introductory classes to the use of individual design applications - Rhinoceros and Grasshopper.

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.W3. records of local spatial development plans to the extent necessary for architectural design;
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.U2. design a simple urban complex;
A.U3. prepare planning studies concerning spatial development and interpret them to the extent necessary for designing in an urban and architectural scale;
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;
A.U9. implement the principles and guidelines of universal design in architecture, urban planning and spatial planning.

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:

Formative evaluation:
• Lectures: test - checks the knowledge and understanding of the presented issues.
• Laboratory classes: Evaluation of work during particular classes. The grading scale: 2.0; 3.0; 3.5; 4.0; 4.5; 5.0 Summative evaluation
• laboratory classes: grade point average for grades obtained in particular classes
• lectures: the grade for the written test; the grading scale: 3.0; 3.5; 4.0; 4.5; 5.0

Programme content

As part of the course, the basics of algorithmic design of architecture and solving problems related to it are presented. During the classes, examples of practical use of modern computer instruments are discussed, with an emphasis on the Rhinoceros + Grasshopper program. Theoretical foundations of computer-aided design are also presented. Issues related to a wide range of computer software and hardware applications are discussed. The engineering and architectural practice is discussed in relation to the presented IT issues. Attention is also drawn to the important role played by information technology in the field of coordination and exchange of design data. Individual issues are discussed on examples of specific design applications and algorithms used in practice. The discussed issues are of a nature that is the basis for students' own, creative searches, in direct connection with the laboratory exercises in the subject. The aim of the course is to provide the basics of current knowledge: theoretical and practical in the field of

parametric and generative design. Lectures are also a theoretical introduction to practical classes held as part of laboratory exercises. Introductory issues, computer-aided design in the architect's workshop. The topics covered during theoretical and practical classes are: simulation and computational software, expert systems, artificial intelligence, structural "skin" - technological methods of building complex curvature surfaces in modern parametric architecture, cellular automata, l-systems, fractals - the IT foundations of generative architecture and optimization in parametric architecture - evolution and swarming patterns, 3D printing and cnc fabrication - new tools in parametric and generative architecture, machine learning, C # coding.

Course topics

w1: A Brief History of Parametric Design.
w2. Designing Technical Parameters - from the Urban Scale to Industrial Design.
w3: Optimization in Parametric Architecture.
w4: Designing Technical Parameters for Ecological and Functional Architecture
w5: Algorithms: Random Structures, Aggregations, Attractors.
w6: Complex Structure Technology in Parametric Architecture
w7: Programming Basics, Algorithms, Machine Learning, AI in Parametric Architecture
w8: Exam

Teaching methods

Lecture: lecture / problem session / lecture with a multimedia presentation; laboratory classes: doing experiments with the use of the software which illustrates the typical design problems, having received instructions; project method: project – practical; case analysis / discussion / problem solving

Bibliography

Basic:
Współczesne projektowanie parametryczne w architekturze / Wojciech Bonenberg (WA), Marcin Giedrowicz (WA), Kacper Radziszewski / Poznań, Polska : Wydawnictwo Politechniki Poznańskiej, 2019 - 365 s.

Additional:
1. Archivolta – wszystkie wydania z 2013 – 2014 roku, Wydawnictwo Archivolta, Węgrzce Kasznia Dariusz, Magiera Jacek, Wierzowiecki Paweł, BIM w praktyce, Wydawnictwo Naukowe PWN,2018
2. Januszkiewicz K. "O projektowaniu architektury w dobie narzędzi cyfrowych. Stan aktualny i perspektywy rozwoju." Oficyna Wydawnicza Pwr., Wrocław 2010
3. Helenowska - Peschke M. "Parametryczno - algorytmiczne projektowanie architektury", Wydawnictwo Politechniki Gdańskiej , Gdańsk 2014
4. Tedeshi A., AAD_Algorithms-aided desig, Le Penseur Publisher, 2014, ISBN 978-88-95315-30-0s for architectural practice, IAI, Wiley 2011

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	45	2,00