GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	CAD. Integrated Architectural Design, PG_00063672
Field of study	Architecture

Date of commencement of studies	October 2024	Academic year of realisation of subject	2024/2025
Education level	second-cycle studies	Subject group	Optional subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	assessment

Conducting unit	Department of Visual Arts -> Faculty of Architecture

Name and surname of lecturer (lecturers)	Subject supervisor	mgr inż. arch. Kacper Radziszewski
	Teachers	mgr inż. arch. Kacper Radziszewski

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	0.0	45.0	0.0	0.0	45
	E-learning hours included: 0.0						

Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
	Number of study hours	45	8.0	47.0	100

Subject objectives	The aim of the course is to expand digital competences and present the possibilities of using various specialist computer programs used in architectural and urban design.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_W03] knows and understands the history and theory of architecture as well as art, technology and humanities to the extent necessary for the proper performance of architectural designs; advanced issues related to architecture and urban planning useful for designing architectural objects and urban complexes in the social, cultural, natural, historical, economic, legal context and other non-technical conditions of engineering activities, integrating knowledge acquired during studies	knows and understands advanced issues related to architecture and urban planning useful for designing architectural objects and urban complexes in the context of various non-technical conditions of engineering activities, integrating the knowledge acquired during studies	[SW3] Assessment of knowledge contained in written work and projects
	[K7_U01] is able to use the experience gained during studies to make a critical analysis of the conditions and formulate conclusions for design in a complicated, interdisciplinary context	is able to use the experience gained during studies to critically analyze conditions and formulate conclusions for design in a complex, interdisciplinary context	[SU2] Assessment of ability to analyse information
	[K7_U03] is able to prepare advanced graphic, written and oral presentation of own design concepts in the field of architecture and urban planning, meeting the requirements of a professional record appropriate for architectural and urban design	is able to prepare advanced graphic, written and oral presentation of own design concepts in the field of architecture and urban planning, meeting the requirements of a professional record appropriate for architectural and urban design	[SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task

Subject contents	
	Classes are held in several groups implementing original programs of the instructors: **A.** During classes, students learn methods of recording a project in the form of an algorithm using visual programming. The laboratories cover basic terms and methods of data recording, processing, visualization and a review of selected algorithms used in architectural design.

Classes on the design of facades with the use of computer programming. Classes using Rhinoceros + Grasshopper3d software. During the laboratory, students will work on the design of the curvilinear facade.

Students in pairs or individually design the facade system, which will then be written in the form of an algorithm using Grasshopper3d. Each of the classes consists of two stages: introduction to a new issue in the software and the design part, during which students work on developing the algorithm. During the course, students will use additional grasshopper libraries such as LunchBox and Weaverbird.

   introduction to the content of the course and getting to know the Rhinoceros software interface + exercise
   introduction to Grasshopper3d software + exercise
   2d algorithmic modeling (voronoi diagram)
   3D algorithmic modeling (SANAA Pavilion)
   3d algorithmic modeling (attractor)
   3D modeling of rhinoceros surface and lunchbox accessory
   3d modeling Grasshopper and Weaverbird add-on
   own work on the concept of the facade and record the design in the form of algorithm steps
   introduction to data visualization in Grasshopper3d
   working in Grasshopper3d on advanced detail modeling (part 1)
   working in Grasshopper3d on advanced detail modeling (part 2)
   work at Grasshopper3d on visualization and data export methods
   work in Grasshopper3d on the solution of the concept (online consultations during the classes) (alone or in pairs)
   work at Grasshopper3d on the solution of the concept (online consultations during classes) (alone or in pairs)
   work on presenting the project

B. The aim of the classes will be to learn GIS and BIM elements, which will be useful primarily when working on urban and architectural concepts - acquiring, processing and visualizing geographic data using GIS and basic BIM tools for conceptual modeling (terrain modeling, solid modeling environment, modification and parameterization of conceptual solids). The classes concern the use of the GIS environment and BIM software to create urban and architectural concepts. During the classes, the QGIS platform, a selected application for collecting data in the field and Autodesk Revit software will be used. Students in pairs or individually prepare a solid concept and land development based on the collected information, developed analyses and formulated design guidelines resulting from local conditions. The subject of the study may be a selected undeveloped area in the Tri-City area or another area related to architectural design classes. Each class consists of 2 stages: introduction to a new issue and independent analysis or design task. The classes consist of the following stages:1. Introduction2. Sources and properties of GIS data, basics of spatial analysis.3. Collecting data in the field, GIS in creating land development concepts.4. Visualization of data and analysis results in GIS.5. Introduction to BIM and basics of Autodesk Revit.6. Autodesk Revit - terrain modeling, solid modeling environment, modification and parameterization of conceptual solids - creating architectural concepts.Summary. Elements of integration of GIS and BIM systems.

(part 1 - project implemented thanks to a grant from IDUB/Didactic Innovation Competition organized by the Center for Modern Education)

C. The aim of the classes is to gain knowledge on the use of the open-source program "Blender" to create architectural concepts and projects in the openBIM standard and also to create professional architectural visualizations.Classes on the use of Blender to create BIM models and architectural visualizations using the integrated Cycles rendering engine.Advanced modeling techniques will be presented, both in relation to cubic architectural forms (simple box modeling), as well as architectural or interior details - such as windows, balustrades or lamps (hard surface modeling, spline modeling, subdivision modeling). The classes will also present tools used to model the environment, i.e. terrain, paths or sidewalks. Students will learn about the possibilities of structuring and optimizing the work environment - creating libraries of elements used in the project, optimizing large design files. All issues related to modeling will be presented in relation to the openBIM standard, taking into account the possibilities of Blender as a tool for architectural design. The next stage of the course will be the preparation of scene lighting in relation to architectural and interior visualization, various types of light sources will be presented, including HDRi maps. Students will learn the basics of creating advanced, realistic materials (PBR) and tools for mapping textures on 3D objects (texture painting, UVW mapping). Students will also learn about the possibilities of creating a natural environment based on ready-made models of grass, shrubs and trees (particle systems, proxy, LOD). The final stage of the course will be preparing the scene for rendering, its optimization and post-processing tools. |

Prerequisites and co-requisites	Knowledge of CAD software.
	Knowledge of 3d modeling in any software.

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	design	70.0%	40.0%
	laboratory reports	70.0%	60.0%

Recommended reading	Basic literature	AAD_Algorithms-Aided Design, Parametric Strategies Using Grasshopper,Author: Arturo Tedesch
		Bonenberg, Wojciech, Giedrowicz, Marcin, Radziszewski, Kacper. (2019). Współczesne projekowanie parametryczne w architekturze
		https://www.modelab.is/grasshopper-primer
		https://www.grasshopper3d.com/
		Szczepanek R. (2017), Systemy informacji przestrzennej z QGIS : podręcznik akademicki. Cz. 1 i 2, Wydawnictwo PK, Kraków
		D. Kasznia, J. Magiera, P. Wierzowiecki (2018), BIM w praktyce, Wydawnictwo naukowe PWN, Warszawa.
		Brito Allan, *Blender 2.9 for Architecture,* Wydawnictwo własne, 2020.
	Supplementary literature	Architectural Geometry 1st Edition,by Helmut Pottmann, Bentley
		Dokumentacja Autodesk Revit 2021.
		Podręcznik użytkownika QGIS 3.10.
		Brito Allan, *Blender 2.8 parametric modeling,* Wydawnictwo własne, 2019.
		Brito Allan, Blender 2.9: The beginner's guide, Wydawnictwo własne, 2020.
	eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	parametric modeling of Voronoi 2d geometry
	SANAA Pavilion algorithmic modeling
	modeling of a curvilinear facade with the use of panels and structures
	The task involves performing preparatory exercises and developing an urban and architectural concept for the development of a selected area based on:- urban analyses on a city and district scale using GIS tools-architectural analyses (visual and compositional) using BIM tools (Autodesk Revit).
	1. Modeling window openings.2. Modeling window frames.3. Assigning IFC classes to objects.4. Setting scene lighting with HDRi maps.

Work placement	Not applicable

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