Subject description

Faculty of Architecture, WUT 2020, **Architecture** studies

Architecture for Society of Knowledge specialty

BiM in Practice		**ASK3-KW-Bp**	**MSc level**	**semester 3**
Classes: **seminar**	Hours/semester **30**	Student's own workload hours: **18**	Status: **obligatory** Level: **Advanced** **Context:** **workshop**	ECTS: **2** Exam: **no**

ECTS obtained with personal contact with teacher: 2
ECTS obtained during practical profiled classes: 2

Unit delivering this subject: Katedra Projektowania Architektonicznego
Pracownia Projektowania Architektonicznego Wspomaganego Komputerem
Subject coordinator: mgr. inż. arch. Paweł Przybyłowicz
Teacher: mgr. inż. arch. Paweł Przybyłowicz, mgr inż. arch. Karolina Ostrowska

Learning outcomes and subject delivery methods

Objective of the course:

After completing the seminar, students know design techniques supported by Building Information Modeling (BIM and its use in team collaboration. Autodesk's Revit Architecture was selected to achieve the goal. The program is compared to other competitive systems (Archicad by Graphisoft and Architecture by Bentley), showing the differences and similarities in the technique of mapping the physical, functional and structural properties of a building. During the course, the rules of team cooperation are applied.
The teams' task is to develop assigned, multi-branch project documentation. Target to develop a three-dimensional, digital object model that reflects the complexity of information generated by real technologies and building materials offered by the market. The summary of the work consists in assessing the effectiveness of the assumed methods of teamwork and assessing the degree of implementation of real technologies in the application of the virtual model.

General description of the course:

The seminar introduces the advanced technology of computer-aided design known as BiM (Building Information Modeling) It is not only a record of the geometry of the object but also a reflection of real technologies and building materials available on the market. BIM is useful not only in the design process but also the implementation and operation of the facility. The software selected for the project is presented on the background of related programs.
In the first phase of the seminar, participants form teams and prepare a teamwork scenario.
The entrusted design documentation represents several buildings, each developed by two independent teams. Teams recognise the assigned design documentation and specify the technology of building implementation in the field of ceiling walls, lintels of windows and doors, and roof coverings. In the second phase, participants implement selected communication and teamwork techniques to efficiently create a virtual model. During the carrying out of the model, selected persons deal with obtaining and supplying relevant parametric information related to selected technologies and building materials. At the end of the process, the teams present models and assembly sheets that form the basis for the buildings costs calculation.
Seminar summary:
- analysis and evaluation of the effectiveness of the adopted methods of team cooperation,
- analysis and evaluation of the availability and form of information about products and technologies,

- software analysis and evaluation regarding the effectiveness of the model implementation as a virtual equivalent of a real object.
Analyses and assessments are made by comparing the work of individual teams. The discussion leads to the selection of the most effective methods of achieving the objectives of the task.

Learning outcomes:

No. of the outcome/ area	Description
Knowledge	
W_01	Student has theoretically founded knowledge about BiM.
W_02	Student can set and formulate steps targeted at the team performance of the task.
W_03	Student realises the object model, based on real data obtained from producers of building materials.
Skills	
U_01	Student uses selected software supporting the BiM attitude.
U_02	Student can analyse and interpret the effects of carried out activities.
U_03	Student can propose a strategy for the implementation of BiM technology to carry out a design task.
Social competences	
KS_01	Student can interact and work in a group performing different roles.
KS_02	Student can act and think creatively.

Learning contents:

Introduction to the problems of Building Information Modelling - BiM
Subject overview, classes organisation, topics and timetable
Topics specification of the seminars and methods of task implementation.
Implementation:

- Publication of virtual model
    - author's presentation
    - the lecturer's assessment
    - team evaluation
    - final evaluation
    - presentation of results
- Tips for installing the necessary software
    - installation of Revit Architecture software
    - software registration
- Task 1
    - Development of principles of team cooperation
    - Specification of tasks for individual group members.
- Task 2
    - Analysis of entrusted construction documentation
    - Recognition of industry issues: architecture, design, internal installations
    - Analysis of building parts: foundations, foundation walls, external walls, structural walls, partition walls, ceilings, lintels, windows, doors, roof structure, roof sheathing.
- Task 3
    - Selection of technologies and producers of building materials
    - analysis of technologies regarding their applicability in the project
- Task 4
    - Analysis of access to information on the network
    - analysis of access to information in the field of building materials
- Task 5
    - Model building - defining the template
    - initial settings: defining project units and user settings
- Task 6
    - Model building - underlay

    - methods of using vector and raster trace
- Task 7
    - Model building – defining families
    - definitions of: foundations, foundation walls, external walls, structural walls, external walls, partition walls,
- Task 8
    - Model building - defining families
    - definitions: ceiling beams, ceilings, lintels, roof
- Task 9
    - Model building - loaded components
    - methods of defining custom components
- Task 10
    - Model building - definition of summary sheets
    - defining custom summary sheets
- Task 11
    - Model building - user parameters
    - Methods for defining user's procedures and variables
- Overview: a comparative analysis of models
    - analysis of teamwork techniques
    - analysis of obtained information about technologies and products
    - analysis of defined objects 'families'
    - analysis of the implementation phases of the virtual model
- Publication of a virtual model
    - the lecturer's assessment
    - team evaluation
    - final evaluation

Teaching methods and forms :

Compulsory lectures implemented in a two-hour cycle per week, alternating with seminar classes 2h. The content of lectures and exercises published on the e-learning platform.
Elementary tasks: the specification of principles of team cooperation; analysis of assigned construction documentation, analysis of offered building technologies, learning the software at the primary level, analysis of information searching methods; analysis of construction industry dedicated sites.
Primary task: implementation of a virtual model and presentation of data in the form of a premise and analysis of the object's costs.

Method of testing the learning outcomes:

Outcome number	**Way of testing**
Knowledge	
W_01	Lectures, subject literature, scored practical exercises
W_02	Obligatory partial tasks evaluated using the point method
W_03	Effects of elementary exercises and final effect presentation
Skills	
U_01	Partial tasks - building elements of the model structure
U_02	Virtual model
U_03	Lecturer's and peer evaluation
U_04	Exchange of experience between participants
Social competences	
KS_01	Team collaboration, assessment based on the observation of lecturer during the workshop

Literature:

- National Building Information Model Standard Project Committee, http://www.buildingsmartalliance.org/index.php/nbims/faq/
- 2 Smith, Deke (2007). "An Introduction to Building Information Modeling (BIM)"
- Eastman, Chuck (August 2009).

"What is BIM?"
- Definition of Building Information Modelling, http://www.cpic.org.uk/en/current-projects/bim/building-information-modelling.cfm
- Discussion of the BIM acronym http://www.aecbytes.com/newsletter/2004/issue_5.html
- NIST (2004), *Cost Analysis of Inadequate Interoperability in the U.S. Capital Facilities Industry* - http://www.bfrl.nist.gov/oae/publications/gcrs/04867.pdf
- NBS Roundtable discussion, http://www.thenbs.com/roundtable/