Course guide
310426 - 310426 - Advanced 3D Modeling for Construction Processes

Unit in charge: Barcelona School of Building Construction
Teaching unit: 752 - RA - Departamento de Representación Arquitectónica.
Degree: MASTER'S DEGREE IN ADVANCED BUILDING CONSTRUCTION (Syllabus 2014). (Optional subject).
Academic year: 2022  ECTS Credits: 5.0  Languages: Catalan, Spanish, English

LECTURER

Coordinating lecturer: Sarró Garcia, Pedro
Others: Guillermo José Farinós Pérez

PRIOR SKILLS

Basic knowledge of construction processes
Basic knowledge of any 3d modeling software (3dsmax, revit, blender, sketchup ...)

REQUIREMENTS

To have a computer that allows the use of conventional 3D programs, both for telematic classes and for the proposed exercises

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CE1. Capacity of innovation: identify the reasons and the mechanisms of the technologic and technical changes.

Generical:
CG3. Prepare the student in the using of tools that are common in the investigation activities, like the analysis and treatment of data, just like methodology and investigation techniques.

Transversal:
06 URI. EFFECTIVE USE OF INFORMATION RESOURCES. Managing the acquisition, structure, analysis and display of information from the own field of specialization. Taking a critical stance with regard to the results obtained.

Basic:
CB7. The students must be able to apply the acquired knowledges and their ability of resolution of problems in new or little known environments inside more wide environments (or multidisciplinary) related with their study field.
CB9. The students must be able to communicate their conclusions and the knowledges and ultimate reasons which support to specialised and non-specialised audiences in a clear mode and without ambiguities.
TEACHING METHODOLOGY

This is a practical course that aims to help students represent and interpret construction processes through the virtual construction of these for subsequent visualisation using virtual reality techniques.

In each course different interactive constructive details will be developed, generating a repository for the school, based on a specific theme, previously agreed with the students and based on a preliminary orientation by the teacher.

The course will be divided into two blocks:

1. Constructive details in BIM: all the tools that these tools allow us to generate constructive details in 3D and 2D will be explained. Previews of the details in Enscape are made in each of its phases, as a motivation for the generation of the interactive applications and an optimization of the 3Ds Max models will be made, to add more detail and realism.

2. AR and VR techniques: An interactive application will be made in Unity 3D, with the explanation of the constructive detail and the constructive process. Emphasis will be placed on the use of the interactive tool as a means of communication, being fundamental in this case the presentation and justification of the case study developed by each student.

LEARNING OBJECTIVES OF THE SUBJECT

Objective is focused on learning the latest virtual representation technologies applied to the visualization of construction processes. Students have to know about different elements that make them up, and the execution process will be developed virtually.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours small group</td>
<td>5,0</td>
<td>4.00</td>
</tr>
<tr>
<td>Guided activities</td>
<td>10.0</td>
<td>8.00</td>
</tr>
<tr>
<td>Self study</td>
<td>90.0</td>
<td>72.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>15.0</td>
<td>12.00</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>5.0</td>
<td>4.00</td>
</tr>
</tbody>
</table>

Total learning time: 125 h
Construction details in BIM

Description:
will explain all the tools that these tools allow us to generate constructive details in 3D and 2D. Previews of the details in Enscape are made in each of its phases, as a motivation to the generation of the interactive applications and an optimization of the models in 3Ds Max will be made, to add more detail and realism.

1 introduction to BIM Technologies
1.2 Project methods, from DAC to BIM
1.1 Trend of BIM programs to the procedural field
1.3 Reform, rehabilitation, new construction at BIM
2. Building and environment, basic construction systems
2.1 Topography and foundations
2.2 Vertical and horizontal elements
2.3 Enclosures, facades and roofs
2.4 Predefined systems and modulation
2.5 Complex facade geometries
2.6 Masses
3. Structures and construction details
3.1 Concrete and Metal Structures
3.2 Visualization and generation of construction details
3.3 Construction details as typologies of BIM elements
3.4 Families, types and specimens.
3.5 Basic parameters
4. Development of phases, project options and information exchange
4.1 Compatibility and exchange of projects with other programmes
4.2 Design options
4.3 Project phases
5. Presentation of documentation and data collection
5.1 2D and 3D graphic documentation
5.2 Preview systems in Enscape
6. Model optimization for interactive 3Ds Max platforms
6.1. Typological errors in 3D models

Specific objectives:
- That the students improve their skills in the field of 3D at a constructive level, so that they are able to generate the constructive process of a virtual model from its constructive influence, modelling each of its phases and then visualising it with virtual reality techniques, interactively unincreased.
- To extend the knowledge of BIM programs such as Revit and to know the current trend.
- Reinforce the ability to represent constructive details in planes
- Optimize 3D models
- To make quick and efficient renderings of the projects, for their exhibition

Related activities:
At this stage of the class, the explanation of the construction process must be very clear, with correct documentation of both the plans and the model in detail.

Full-or-part-time: 70h
Theory classes: 8h 20m
Practical classes: 11h 40m
Self study : 50h
Interactive AR and VR of the construction detail

Description:
An interactive application will be made in Unity 3D, with the explanation of the constructive detail and the constructive process. Emphasis will be placed on the use of the interactive tool as a means of communication, being fundamental in this case the presentation and justification of the case study developed by each student.

6. News, programmes and trends
6.1. Interactive projects
7. Basics for making an interactive project in Unity 3D
7.1. Navigation, interface, interaction and context
7.2. 3D model animation
8. Viewing
8.1. Shaders, textures and materials
8.2. Lighting
8.3. High-Definition render Pipeline
9. Menus and user interface
9.1. Basic programming
Interacting with animated objects and physics
10. Export project
10.1. The export menu
10.2. Quality and format settings

Specific objectives:
- Widening the spatial vision, managing to capture a constructive detail on reality, through augmented reality techniques.
- More knowledge of constructive details when seeing the projects of the partners.
- Strengthen the capacities of expression in public, supported by the use of technological tools

Related activities:
A presentation of the interactive projects will be made.
The applications will also be developed for a WEB format, provisionally in local, but it is planned to create in the future a repository that will grow with the work of the students.

Full-or-part-time: 51h
Theory classes: 8h 20m
Practical classes: 6h 40m
Self study : 36h

GRADING SYSTEM
The evaluation will consist of 70% in the final delivery of the application along with the file used and a small public presentation on its development, difficulties and solutions provided. And 10% for each of the exercises proposed in each block

EXAMINATION RULES.
It is an essential condition to do all the activities to access to the final mark.
BIBLIOGRAPHY

Basic:

RESOURCES

Other resources:
https://www.autodesk.com/education/free-software/revit
https://www.autodesk.com/education/free-software/3ds-max