CONSTRUCTION SYSTEMS AND APPLICATIONS 3

IE University
Professor: ALEJANDRA ALBUERNE RODRÍGUEZ
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Academic year: 22-23
Degree course: THIRD
Semester: 2º
Category: COMPULSORY
Number of credits: 6.0
Language: English

PREREQUISITES
Construction Systems 1 & 2 will form the basis for this course.

SUBJECT DESCRIPTION
Construction Systems 3 will complement the learnings from earlier modules. Focus is placed on two key areas of architectural construction technology: the building envelope and the existing.

Addressing the building envelope completes the journey started in Construction Systems 2 to explore the different primary elements of a building. The envelope is understood not as the skin of a building, but as a multi-faceted transition from the exterior to the innermost interior of a building. The ability to propose a diversity of solutions that match the environmental and user requirements is essential for the delivery of efficient and comfortable architecture. It is also an area where innovation and technology can play a key role, and this is encouraged through exploration and practice in the course.

The existing is increasingly recognised as a necessary field of action in response to the current tensions between the built environment and the climate crisis. Existing buildings are a resource architects must be able to tap onto in order to optimise our use of natural and material resources. In coordination with Design Studio 6, students will learn about past construction technologies and about the intricacies, strategies and methodologies available for understanding, assessing, reusing and upgrading existing constructions.

OBJECTIVES AND SKILLS
2.1. Course objectives and acquired skills
BASIC AND GENERAL OBJECTIVES
CB1: Students have demonstrated knowledge and an understanding of a given area of study, building upon the foundation of secondary education, supported by advanced texts, and including aspects that engage the latest advances in their area of study.
CB2: Students know how to apply their knowledge professionally to their work or vocation and possess the competencies that are often demonstrated through elaboration and defense of arguments and the resolution of problems within their area of study.
CB3: Students can gather and interpret relevant facts (usually within their area of study) in order to make judgments that include reflection on relevant social, scientific, and ethical topics.
CB5: Students can transmit information, ideas, problems, and solutions to both specialized and non-specialized audiences.
CB6: Students have developed the necessary learning skills to continue their studies with a high degree of autonomy.

SPECIFIC COMPETENCIES
Per the Ministerial Decree EDU/2075/2010, 29 of July:

TECHNICAL MODULE (CE 12-33)
(W: Workshop Format)
CE12: Ability to devise, calculate, design and implement foundation solutions, and to integrate them into buildings and urban assemblies (W).
CE13: Ability to apply technical and constructive codes and regulations.
CE14: Ability to preserve building structures, foundations and public works.
CE15: Ability to preserve finished work.
CE16: Ability to create cost estimates for built work.
CE17: Capacity to develop, calculate, design, and execute building structures, and to integrate them into buildings and urban complexes (W).
CE18: Capacity to develop, calculate, design, and execute interior partitions, carpentry, stairs and other finished work, and to integrate them into buildings and urban complexes (W).
CE19: Capacity to develop, calculate, design, and execute enclosure systems, roofs/coverings, and other structural work, and to integrate them into buildings and urban complexes (W).
CE20: Capacity to develop, calculate, design, and execute the supply, treatment, and drainage of heating and cooling fluids, and to integrate this into buildings and urban complexes (W).
CE21: Capacity to preserve structural work.
CE22: The capacity to design building and urban installations of electrical transformation and power supply, audiovisual communication, acoustic conditioning, and artificial lighting.
CE23: The capacity to preserve mechanical and electrical systems.
CE24: Adequate knowledge of the mechanics of solids, continuous media and soil, as well as the plastic, elastic, and resistance qualities of heavy building materials.
CE25: Adequate knowledge of conventional construction systems and their pathology.
CE26: Adequate knowledge of the physical and chemical characteristics of the production process, the pathology, and use of building materials.
CE27: Adequate knowledge of industrial construction systems.
CE28: Knowledge of professional ethics, professional organizations, professional structures and civil liability.
CE29 Knowledge of administrative and management procedures and professional processes.
CE30: Knowledge of general office organization.
CE31: Knowledge of techniques for measurement, budgeting, and evaluation.
CE32: Knowledge of project safety and hygiene on site.
CE33: Knowledge of real estate management.

TRANSVERSE COMPETENCIES OF THE UNIVERSITY CT4
Use disciplinary knowledge to analyze and evaluate current situations.

2. Specific objectives and skills
Specific emphasis will be placed upon achieving the following competencies:
- To understand the basic principles and suitable application and performance of construction materials, products, components and assemblies, as well as their environmental impact.
- To understand conventional building systems and the potential problems associated with them.
- To be able to design elements and systems of foundations, walls, floors, roofs, stairs and fenestration, understanding the building as a whole, in which all the parts are integrated.
- To illustrate through drawing and modelling the relationship of various materials and elements that make up a building construction assembly.
- To understand the principles of sustainability in making building construction decisions in order to conserve natural and built resources.
- To understand the building codes and standards and to familiarize with current code (CTE) development processes.

**METHODOLOGY**

The course is delivered through a combination of lectures and practical exercises aimed at putting into practice key learnings. There are two content blocks, each comprising lectures and an assessed practical exercise:

- The existing: lectures will address traditional construction technology, pathology, surveying of existing buildings and retrofit of existing buildings. The practical exercise will comprise the survey and evaluation of an existing building.
- The building envelop: lectures will explore the function and composition of the building envelop. A design practical will complete this content block.

Alongside classroom teaching, students will go on site visits to buildings and construction industry manufacturer industries.

<table>
<thead>
<tr>
<th>Teaching methodology</th>
<th>Weighting</th>
<th>Estimated time a student should dedicate to prepare for and participate in</th>
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<tbody>
<tr>
<td>Lectures</td>
<td>20.0 %</td>
<td>30 hours</td>
</tr>
<tr>
<td>Discussions</td>
<td>4.0 %</td>
<td>6 hours</td>
</tr>
<tr>
<td>Exercises</td>
<td>20.0 %</td>
<td>30 hours</td>
</tr>
<tr>
<td>Group work</td>
<td>16.0 %</td>
<td>24 hours</td>
</tr>
<tr>
<td>Other individual studying</td>
<td>40.0 %</td>
<td>60 hours</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100.0 %</td>
<td>150 hours</td>
</tr>
</tbody>
</table>

**PROGRAM**

**SESSIONS 1 - 2 (LIVE IN-PERSON)**

Introduction to the course: contents, aims and objectives, evaluation method and assignments.
Introduction to content block 1: working with the existing in the built environment. Value and pressing needs: from heritage conservation to sustainability. Approaches to conservation.

**SESSIONS 3 - 4 (LIVE IN-PERSON)**

The building lifecycle: Primary agents of deterioration; Understanding decay and building obsolescence. Building maintenance and heritage conservation: strategies.

**SESSIONS 5 - 6 (LIVE IN-PERSON)**

31th October 2022
The existing: Traditional construction technologies and their pathologies: Masonry and timber

**SESSIONS 7 - 8 (LIVE IN-PERSON)**
The existing: 20th century construction technologies and their pathologies - concrete and steel

**SESSIONS 9 - 10 (LIVE ONLINE)**
Primary retrofitting strategies: energy upgrades, structural strengthening.

**SESSIONS 11 - 12 (LIVE IN-PERSON)**
Practical: site visit and survey of existing building exercise

**SESSIONS 13 - 14 (ASYNCHRONOUS)**
Workshop: damage evaluation and conservation proposals. Progress with existing buildings practical.

**SESSIONS 15 - 16 (LIVE IN-PERSON)**
Introduction to building envelope: functions and typologies. General design principles. Case studies from solid wall construction to 21st century technology.

**SESSIONS 17 - 18 (LIVE IN-PERSON)**

**SESSIONS 19 - 20 (LIVE IN-PERSON)**

**SESSIONS 21 - 22 (LIVE IN-PERSON)**
Building envelope design: first review session.

**SESSIONS 23 - 24 (LIVE IN-PERSON)**
Façade apertures: windows, doors - types, materials and detailing

**SESSIONS 25 - 26 (LIVE IN-PERSON)**
Workshop: detailing for passive performance. Students will analyse a range of construction details to evaluate environmental performance from different climates.

**SESSIONS 27 - 28 (LIVE IN-PERSON)**
Fieldtrip: visit to precast concrete manufacturers.

**SESSIONS 29 - 30 (LIVE IN-PERSON)**
Building envelope design: final review session

BIBLIOGRAPHY

Compulsory

Recommended
- Roland Krippner, Florian Musso. Facade Apertures. ISBN 9783035611 (Digital)

EVALUATION CRITERIA

Students will be assessed through two individual assignments, corresponding to the two practical exercises that they will carry out throughout the course:
1. Existing building survey report
2. Building envelope design

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<thead>
<tr>
<th>Criteria</th>
<th>Percentage</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual Work</td>
<td>50 %</td>
<td>Existing Building Survey</td>
</tr>
<tr>
<td>Individual Work</td>
<td>50 %</td>
<td>Building Envelope Design</td>
</tr>
</tbody>
</table>

PROFESSOR BIO

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Dr Alejandra Albuere is an architectural engineer with a background in history of architecture and construction, structural design, international development and heritage management. She specialises in traditional and low-cost construction methods and has worked in the conservation and regeneration of historic buildings, including St Paul's Cathedral and Coal Drops Yard in London.

OTHER INFORMATION

Office hours: weekly office hours will be arranged