310031 - Construction VII

Coordinating unit: 310 - EPSEB - Barcelona School of Building Construction
Teaching unit: 753 - TA - Department of Architectural Technology
Academic year: 2018
Degree: BACHELOR'S DEGREE IN ARCHITECTURAL TECHNOLOGY AND BUILDING CONSTRUCTION (Syllabus 2015). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN BUILDING CONSTRUCTION SCIENCE AND TECHNOLOGY (Syllabus 2009). (Teaching unit Compulsory)
ECTS credits: 4
Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: Gibert Armengol, Vicente
Others: Avellaneda Lopez, Alina
Gibert Armengol, Vicente
Pascual Mo, Jordi
Royano García, Verónica

Degree competences to which the subject contributes

Specific:
1. FE-11 Ability to write manuals and maintenance plans and manage its implementation in the building.

Transversal:
2. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 3. Taking social, economic and environmental factors into account in the application of solutions. Undertaking projects that tie in with human development and sustainability.

Teaching methodology

The hours of guided learning consist in:
- Theoretical classe (big group) where the teacher does an exposition to introduce the general goals of learning related to the basic concepts of the subject. In addition it promotes the implication of the student and his learning, with questions and/or practical exercises, motivating an active participation in class. It is used teaching material that is available in ATENEA: programme of the course, presentations in PDF of the Powerpoint files projected in class and recommended bibliography.
- Practical classes (medium group) in which the student works in groups of between 3 and 5 members by solving exercises related to the specific learning objectives of each one of the contents of the subject. In these projects is applied the transverse competence of Sustainability and Social Agreement through the incorporation of these contents in the subject.
- Guided activities where the student works in groups between 3 and 5 members, outside of class and resolving a problem or exercise that requires adding in a sequential from the concepts treated in the theoretical and practical classes of the course. The activites will be done in class and outside of class.
- The autonomous learning is limited to study the topics of the theoretical classes and the recommended lectures, and also to the researceh and use of the software related with the maintenance and its management.

Learning objectives of the subject

At the end of the course, the student should be able to:
- Understand and analyze the life cycle of the construction elements and subsystems which form the buildings.
- Identify and understand the legislation related with the maintenance field.
- Analyze and deduce/distinguish the most suitable intervention types for the preservation of the new property heritage from the design/project phases and the built.
- Develop use manuals, plan maintenance plans and manage its implementation in a building.

### Study load

<table>
<thead>
<tr>
<th>Total learning time: 100h</th>
<th>Hours large group: 20h</th>
<th>20.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours medium group:</td>
<td>10h</td>
<td>10.00%</td>
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<tr>
<td>Hours small group:</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td>Guided activities:</td>
<td>10h</td>
<td>10.00%</td>
</tr>
<tr>
<td>Self study:</td>
<td>60h</td>
<td>60.00%</td>
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</table>
### Content

<table>
<thead>
<tr>
<th>UNIT 1: CONTEXTUALIZATION</th>
<th>Learning time: 32h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 7h</td>
</tr>
<tr>
<td></td>
<td>Practical classes: 2h</td>
</tr>
<tr>
<td></td>
<td>Guided activities: 3h</td>
</tr>
<tr>
<td></td>
<td>Self study: 20h</td>
</tr>
</tbody>
</table>

**Description:**
- Introduction to Maintenance: discussion of the building process; Vision of maintenance in other sectors; Maintenance concept; Aging process of buildings; Legislative framework; Opportunities.
- Product Availability Building: concepts of durability, reliability, maintainability and availability; Identification of major degradation agents; Concept of failure and analysis of its consequences (fault); Evolution of the failure rate over time.
- Study of the Life Cycle of the building: stages of the life cycle; Life cycle cost concepts, lifespan and substitutions; Methodology to estimate the useful life (ESL) and the reference values (RSL); Definition and application of modifying factors.

**Related activities:**
- Theoretical classes.
- Evaluation 1. Individual partial test of continuous evaluation (units 1 and 2).
- Evaluation 2. Individual final test of continuous evaluation (units 1, 2 and 3).
- Practice 1. Test in groups about the Cycle of Life of Buildings.
- Guided Activity. Test in groups of continuous evaluation in both face-to-face or not, about the Analysis of a Constructive Subsystem or Installation of the Building.

**Specific objectives:**
- Be aware of the necessity of the maintenance in building construction and value the advantages in its planification.
- Identify and interpret the legislation related with the field of maintenance.
- Identify the critic elements of a building from a point of view of durability, reliability, and maintenance.
- Identify the threats that favour the degradation of buildings.
## UNIT 2: ANALYSIS

<table>
<thead>
<tr>
<th>Learning time: 30h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 5h</td>
</tr>
<tr>
<td>Practical classes: 2h</td>
</tr>
<tr>
<td>Guided activities: 3h</td>
</tr>
<tr>
<td>Self study: 20h</td>
</tr>
</tbody>
</table>

### Description:
- Classification and Identification of Buildings: main uses of a building and the importance of spaces; Structuring the information of a building; Fragmentation and organization of spaces.
- Maintenance Strategies: introduction to the maintenance of buildings, types and activities; Contributions of the CTE to the maintenance; Application of sustainability criteria.

### Related activities:
- Theoretical classes.
- Evaluation 1. Individual partial test of continuous evaluation (units 1 and 2).
- Evaluation 2. Individual final test of continuous evaluation (units 1, 2 and 3).
- Practice 2. Test in groups about the Value of Chains.
- Guided Activity. Test in groups of continuous evaluation in both face-to-face or not, about the Analysis of a Constructive Subsistem or Installation of the Building.

### Specific objectives:
- Identify the different uses that are developed in a building.
- Classify the spaces of a building according to its using.
- Identify, analyze and deduce/distinguish the more adequate typologies of intervention for the patrimonial real state conservation of new construction, from phases of design/project, to the construction.
### UNIT 3: DEVELOPMENT

<table>
<thead>
<tr>
<th>Description:</th>
<th>Learning time: 34h</th>
</tr>
</thead>
<tbody>
<tr>
<td>In this unit is worked:</td>
<td>Theory classes: 6h</td>
</tr>
<tr>
<td>· Design of the Maintenance Plan: concepts of the Building Book and Maintenance Plan; Structure of the Book of the Building; Documents for Use and Maintenance; Development of the Maintenance Plan and tools for its development.</td>
<td>Practical classes: 4h</td>
</tr>
<tr>
<td>· Maintenance Management: Introduction to Information Systems; Concept of CMMS and modular structure; Operational management and supervision of the maintenance service; Background data; Examples of CMMS and other management tools; BIM integration; Management models.</td>
<td>Guided activities: 4h</td>
</tr>
<tr>
<td>Related activities:</td>
<td>Self study : 20h</td>
</tr>
<tr>
<td>Theoretical classes.</td>
<td></td>
</tr>
<tr>
<td>Evaluation 2. Individual final test of continuous evaluation (units 1,2 and 3).</td>
<td></td>
</tr>
<tr>
<td>Practice 3. Test in groups about the Plan of Maintenance and the Book of the Building.</td>
<td></td>
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<tr>
<td>Practice 4. Test in groups about GMAO / CMMS.</td>
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<tr>
<td>Guided Activity. Test in groups of continuous evaluation in both face-to-face or not, about the Analysis of a Constructive Subsystem or Installation of the Building.</td>
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<tr>
<td>Specific objectives:</td>
<td></td>
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<tr>
<td>Develop manuals of use, programme maintenance plans and manage its implantation in a building.</td>
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</tbody>
</table>
### Planning of activities

| PRACTICE 1. LIFE CYCLE OF THE BUILDINGS | Hours: 2h  
Practical classes: 2h |
<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td></td>
</tr>
<tr>
<td>The practice consists in the analysis of the cycle of life of a subsystem or constructive element that will choose the teacher. At the beginning of the practice the wording is shown and, the development and the ending are done in the class, in groups from 3 to 5 students and in the class. Once is evaluated the practice can be discussed with the teacher, if the students want and at the hours of permanence.</td>
<td></td>
</tr>
<tr>
<td><strong>Support materials:</strong></td>
<td></td>
</tr>
<tr>
<td>Wording of the practice, script of the exercise and presentation of the topic (PowerPoint - PDF) available in ATENEA.</td>
<td></td>
</tr>
<tr>
<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong></td>
<td></td>
</tr>
<tr>
<td>Resolution of the exercise by the group of students. The practice represents a part of the continuous evaluation (2,5% of the final mark).</td>
<td></td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td></td>
</tr>
<tr>
<td>At the end of the activity, the students must be capable of:</td>
<td></td>
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<tr>
<td>- Analyze the cycle of life of a subsystem or constructive element.</td>
<td></td>
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<tr>
<td>- Apply the regulations to estimate the useful life of the constructive elements and the number of substitutions for a temporal horizon.</td>
<td></td>
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<tr>
<td>- Interpret and value the results.</td>
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</tbody>
</table>

| PRACTICE 2. CHAINS OF VALUE | Hours: 2h  
Practical classes: 2h |
<table>
<thead>
<tr>
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<th></th>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td></td>
</tr>
<tr>
<td>The practice consists in the analysis of the cycle of life of a subsystem or constructive element that will choose the teacher, from the point of view of durability and functionality. At the beginning of the practice the wording is shown and, the development and the ending are done in the class, in groups from 3 to 5 students and in the class. Once is evaluated the practice can be discussed with the teacher, if the students want and at the hours of permanence.</td>
<td></td>
</tr>
<tr>
<td><strong>Support materials:</strong></td>
<td></td>
</tr>
<tr>
<td>Wording of the practice, script of the exercise and presentation of the topic (PowerPoint - PDF) available in ATENEA.</td>
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<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong></td>
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<td>Resolution of the exercise by the group of students. The practice represents a part of the continuous evaluation (2,5% of the final mark).</td>
<td></td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td></td>
</tr>
<tr>
<td>At the end of the activity, the students must be capable of:</td>
<td></td>
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<tr>
<td>- Decompose a constructive subsystem, installation or element, identifying the different components that have.</td>
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<tr>
<td>- Identify and value the grade of criticism of each element or piece, from the point of view of durability and functionality.</td>
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</table>
### PRACTICE 3. MAINTENANCE PLAN AND BOOK OF THE BUILDING

**Description:**
The practice consists in write the maintenance plan of a building, or of a part of it, in order to elaborate the Book of the Building.
At the beginning of the practice the wording is shown and, the development and the finalization are done in class, in groups between 3 and 5 students and in a session destined to this effect.
Once is evaluated the practice can be discussed with the teacher, if the students want and at the hours of permanence.

**Support materials:**
Wording of the practice, script of the exercise and presentation of the topic (PowerPoint - PDF) available in ATENEA.

**Descriptions of the assignments due and their relation to the assessment:**
Resolution of the exercise by the group of students.
The practice represents a part of the continuous evaluation (2,5% of the final mark).

**Specific objectives:**
- At the end of the activity, the students must be capable of:
  - Identify the parts of the building that require maintenance.
  - Connect the parts of the building with the necessary maintenance activities to guarantee an optimus durability.
  - Generate calendar of maintenance, distributing the maintenance activities in an iterative way according to a frequency.
  - Estimate the economic valuation of the maintenance activities planned.
  - Elaborate the using and maintenance manual of the building and the flats.
  - Identify the necessary documents to complete the Book of the Building.

### PRACTICE 4. GMAO / CMMS

**Description:**
The practice consists in the simulation of maintenance management through a GMAO or CMMS.
At the beginning of the practice the wording is shown and, the development and the finalization are done in class, in groups between 3 and 5 students and in a session destined to this effect.
Once is evaluated the practice can be discussed with the teacher, if the students want and at the hours of permanence.

**Support materials:**
Wording of the practice, script of the exercise and presentation of the topic (PowerPoint - PDF) available in ATENEA.

**Descriptions of the assignments due and their relation to the assessment:**
Resolution of the exercise by the group of students.
The practice represents a part of the continuous evaluation (2,5% of the final mark).
GUIDED ACTIVITY. ANALYSIS OF CONSTRUCTIVE SUBSYSTEM OR INSTALLATION IN THE BUILDING

Description:
The guided activity consists in a complete analysis of a constructive subsystem or installation of the building from the point of view of its durability, reliability and maintenance. It is done in groups between 3 and 5 students, is divided in two parts and each one of them will be delivered in a partial way according to the calendar of the subject, available in ATENEA. There will be done 5 face-to-face sessions.
- In two of them (one for each part of the guided activity) the teacher explains the wording and orientates the groups of students for its execution.
- Two more (one for each part of the guided activity) will be tracking sessions, in which the groups will explain the teacher the work done and the teacher will revise the work and orientate the students for the correct execution, if it is necessary.
- One final session where the students will defend orally and in front of their schoolmates the two parts of the project delivered.
Each group will develop the project in an autonomous way and can ask for tutorship to the teacher in the hours of non face-to-face guided activity.
Once is evaluated the guided activity can be discussed with the teacher, if the students want and at the hours of permanence.

Support materials:
Wording of the practice, script of the exercise and presentation of the topic (PowerPoint - PDF) available in ATENEA.

Descriptions of the assignments due and their relation to the assessment:
Resolution of the exercise by the group of students.
The practice represents a part of the continuous evaluation (20% of the final mark).

Specific objectives:
At the end of the activity, the students must be capable of:
- Identify the parts of the building and split it up through jerarquic squemes.
- Identify and valorate the grade of criticism of each element or piece, from the point of view of maintenance, durability and reliability.
- Propose improvements of the critic elements related to maintenance, durability and reliability.
EVALUATION 2: INDIVIDUAL FINAL TEST OF CONTINUOUS EVALUATION (UNITS 1, 2 AND 3).

Description:
Individual realization in the class of the test with part of the basic concepts of the units 1 and 2, that covers the specific goals of learning of the contents treated. Correction by the teacher.

Support materials:
Wording of the test.

Descriptions of the assignments due and their relation to the assessment:
Resolution of the exercise by the student.
In case that the students asks for the revision of the the test, the teacher will ease the correction to the student to compare with the evaluation criteria. The students will have 20 days, from the date of publication of the qualifications to ask for the revision of the test.
The practice represents a part of the continuous evaluation (20% of the final mark).

Specific objectives:
At the end of the activity, the students must be capable of:
- Identify and use correctly the terminology and applicable techniques to the conservation and the maintenance of buildings.
- Identify the legal regulations about maintenance.
- Define criteria of conservation, maintenance and reliability applicable to the real-estate environment.
- Analize buildings for the optimization of its maintenance.
- Valorate, evaluate and criticise in bas to maintenance criteria.
- Identify and interpret conflicts in projects or existance buildings from the gradient of maintenance.
- Interpret the particularities of the use typologies in buildings and associated services of its maintenance.
- Identify typologies of maintenance and define activities.

<table>
<thead>
<tr>
<th>EVALUATION 2: INDIVIDUAL FINAL TEST OF CONTINUOUS EVALUATION (UNITS 1, 2 AND 3).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description: Individual realization in the class of the test with part of the basic concepts of the units 1, 2 and 3, that covers the specific goals of learning of the contents treated through all the course. Correction by the teacher.</td>
</tr>
<tr>
<td>Support materials: Wording of the exam.</td>
</tr>
<tr>
<td>Descriptions of the assignments due and their relation to the assessment: Resolution of the exercise by the student. In case that the students asks for the revision of the the test, the teacher will ease the correction to the student to compare with the evaluation criteria. At the end of the course it will be known the date for the revision of the test following the teaching calendars and the indications of the School's Direction. The practice represents a part of the continuous evaluation, 40% of the final mark.</td>
</tr>
<tr>
<td>Specific objectives: At the end of the activity, the students must be capable of:</td>
</tr>
<tr>
<td>All the content mentioned for the Evaluation 1.</td>
</tr>
<tr>
<td>Elaborate Books of the Building.</td>
</tr>
<tr>
<td>Write an manage maintenance plans.</td>
</tr>
</tbody>
</table>

Hours: 22h
Theory classes: 2h
Self study: 20h
The final mark is the adding of the following partial marks:

\[ Q_{\text{final}} (100\%) = Q_{\text{pct}} (60\%) + Q_{\text{pg}} (10\%) + Q_{\text{ad}} (20\%) + Q_{\text{pa}} (10\%) \]

Essent:
- \( Q_{\text{final}} \): final mark (100%)
- \( Q_{\text{pct}} \): test of the theoretical contents (60%) - Units 1 i 2.
- \( Q_{\text{pg}} \): group practices (10%) - Practices 1, 2, 3 i 4.
- \( Q_{\text{ad}} \): guided activity (20%)
- \( Q_{\text{pa}} \): active participation in class (10%)

Where:
- \( Q_{\text{pct}} (60\%) = Q_{\text{av1}} (20\%) + Q_{\text{av2}} (40\%) \)
- \( Q_{\text{av1}} \): mark Evaluation 1 (20%)
- \( Q_{\text{av2}} \): mark Evaluation 2 (40%)

**Qualification system**

**Regulations for carrying out activities**

Continuous evaluation: If some of the learning activities is not done, this will be considered as non punctuated and non recoverable.

Active participation in class: If there isn't active participation in the teaching activities (in theoretical and practical classes, also in the guided activity), this will be considered as non punctuated and non recoverable.

Defense of the guided activity: In order to do the defense of the guided activity at the end of the course, it will be necessary to deliver the two parts of the project. If the defense is not done, this won't be evaluated.
Bibliography

Basic:


Complementary:


Others resources:


