310077 - Buildings Diagnostics and Energy Rehabilitation

**Coordinating unit:** 310 - EPSEB - Barcelona School of Building Construction

**Teaching unit:**
- 748 - FIS - Department of Physics
- 753 - TA - Department of Architectural Technology

**Academic year:** 2018

**Degree:**
- BACHELOR'S DEGREE IN BUILDING CONSTRUCTION SCIENCE AND TECHNOLOGY (Syllabus 2009). (Teaching unit Optional)
- BACHELOR'S DEGREE IN ARCHITECTURAL TECHNOLOGY AND BUILDING CONSTRUCTION (Syllabus 2015). (Teaching unit Optional)

**ECTS credits:** 3

**Teaching languages:** Catalan, Spanish

### Teaching staff

**Coordinator:** ANGELINA PEÑARANDA AYLLON

**Others:**
- MANUEL AGUSTIÑO OTERO
- ANGELINA PEÑARANDA AYLLON

### Degree competences to which the subject contributes

#### Specific:

1. **FB-4** Knowledge of the chemical features of the materials used in construction, its fabrication processes, the methodology of the trials for determining its features, its geologic origin, the environmental impact, the recycling and the residues management.

2. **FB-5** Knowledge of the theoretical basis and the basic principles applied to the construction, of the fluid mechanics, the hydraulics, the electricity and electromagnetism, the calorimetry and thermal comfort, and the acoustics.

3. **FE-12** Knowledge of the evaluation of the environmental impact of the construction and demolition, the sustainability in the construction, and the procedures and techniques to evaluate the energetic efficiency of the buildings.

4. **FE-13** Ability to apply the technical regulation to the construction process, and generate documents of technical specification in the constructive procedures and methods of buildings.

5. **FE-14** Aptitude to apply the specific regulations about facilities in the construction process.

6. **FE-22** Knowledges of the organisation of the professional work and studies, offices and professional societies, the regulations and rules related with the functions which the Building Engineer develops and the responsibility framework associated to the activity.

7. **FE-29** Aptitude to write documents which are part of execution projects made in a multidisciplinary form

#### Transversal:

8. **SELF-DIRECTED LEARNING.** Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.

9. **EFFICIENT ORAL AND WRITTEN COMMUNICATION.** Communicating verbally and in writing about learning outcomes, thought-building and decision-making. Taking part in debates about issues related to the own field of specialization.

10. **SUSTAINABILITY AND SOCIAL COMMITMENT.** Being aware of and understanding the complexity of social and economic phenomena that characterize the welfare society. Having the ability to relate welfare to globalization and sustainability. Being able to make a balanced use of techniques, technology, the economy and sustainability.

11. **TEAMWORK.** Being able to work as a team player, either as a member or as a leader. Contributing to projects pragmatically and responsibly, by reaching commitments in accordance to the resources that are available.

12. **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.
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**Teaching methodology**

Within the new educational framework, it is pretended that the student acquire the enough criteria to face the professional practice from an environmental perspective. The theoretical classes work for introducing the different concepts and the scientific and technological knowledge which will allow to evaluate the construction activity under sustainable and ethical parameters.

The students must develop their work autonomously and will learn to work in team, complementing the information and practising their abilities, the students must solve problems, consider the main questions of the course, analyze their future professional activity and search new solutions or answers to the environmental challenges.

The subject is planned so that the students could apply the knowledge acquired during the course in an effective way to a real project. From the initial diagnosis, the data gathering, the measure collection, the technical drawing, the documental research, the preparation of satisfaction surveys and its treating, etc. From the acquisition of the knowledge it is possible to write an energy restoration project which will be the educational objective of the subject and therefore of the DAC.

**Learning objectives of the subject**

At the end of the subject, the students should be able to:
- Determine the factors and indicators of the environment.
- Explain the meaning of acoustic, thermal and light comfort.
- Diagnose energetically a building.
- Make energy audits.
- Use the current tools of measuring, simulation and data treatment to answer the environmental demands.
- Restore energetically a building.

**Study load**

<table>
<thead>
<tr>
<th>Total learning time: 75h</th>
<th>Hours large group: 12h</th>
<th>16.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group: 9h</td>
<td>12.00%</td>
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<tr>
<td></td>
<td>Hours small group: 9h</td>
<td>12.00%</td>
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<tr>
<td></td>
<td>Guided activities: 0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Self study: 45h</td>
<td>60.00%</td>
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</table>
### Content

<table>
<thead>
<tr>
<th>C1 INTERVENTION IN EXISTING BUILDINGS; CONDITIONING</th>
<th>Learning time: 35h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 10h</td>
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<tr>
<td></td>
<td>Practical classes: 3h</td>
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<td></td>
<td>Guided activities: 2h</td>
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<tr>
<td></td>
<td>Self study : 20h</td>
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</tbody>
</table>

**Description:**
In this content the students work:

**Related activities:**
Activities 1, 2 and 3.

<table>
<thead>
<tr>
<th>C2 ENERGY AUDITS AND INTERVENTION IN EXISTING BUILDINGS</th>
<th>Learning time: 40h</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 10h</td>
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<tr>
<td></td>
<td>Guided activities: 5h</td>
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<td>Self study : 25h</td>
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</table>

**Description:**
The improvement of the energy efficiency of the building park is a current unavoidable demand. The first step to achieve it is the energy diagnosis or audit, which usually allow great energy savings with a low economic investment: reduce the demand and make the building more efficient is the next step, and improve the facilities or incorporate more efficient and ecologic active systems would be the final complement. The objective of this content is to explain the procedures to carry on the energy audits: Public buildings; evaluation tools; parameterization, hardware, experiences, acting routes, etc.

**Related activities:**
Activity 3. Work about an existing building.
### Planning of activities

| **A1 MEASURES OF THE NOISE LEVELS** | **Hours:** 1h  
Laboratory classes: 1h |
<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td><strong>Description:</strong> There will be done a lab practice consisting on taking measures of the noise levels in different spaces and with different activities, there also will be measured the reverberation time of a room. Group activity.</td>
</tr>
<tr>
<td></td>
<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong> 13 % of the mark.</td>
</tr>
</tbody>
</table>

| **A2 Measures of the reverberation time** | **Hours:** 1h  
Laboratory classes: 1h |
<table>
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</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td><strong>Description:</strong> There will be done a lab practice consisting on taking measures of the reverberation time of a room. Group activity.</td>
</tr>
<tr>
<td></td>
<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong> 13 % of the mark.</td>
</tr>
</tbody>
</table>

| **A3 MEASURES OF THE LIGHT LEVELS** | **Hours:** 1h  
Laboratory classes: 1h |
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td><strong>Description:</strong> There will be done a lab practice consisting on taking measures of the light levels of a room. Subsequently there will be done an illumination project with the software recognized by the Código Técnico de la Edificación (CTE) and other softwares. Individual and group activity.</td>
</tr>
<tr>
<td></td>
<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong> 13 % of the mark.</td>
</tr>
</tbody>
</table>

| **A4 MANAGEMENT OF THE COLLECTED INFORMATION** | **Hours:** 1h  
Theory classes: 1h |
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<tr>
<td><strong>Description:</strong></td>
<td><strong>Description:</strong> Analysis of the consumption data in the house from the facturation of the distribution companies. It will be done a constructive description, graphic of the house, where it will appear as a minimum: front view of the facade, top view and some constructive section. From the graphic information and the collected data that we can add, it can be filled the excel tables that are in Atenea.</td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td><strong>Specific objectives:</strong> It will be done a study of the possible improvements, explaining the decision. After that it will be done a written document evaluating the different options studied.</td>
</tr>
<tr>
<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong> 10% of the mark.</td>
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</table>
### A5 INTERVENTION PROPOSAL

**Hours:** 0h 30m  
Theory classes: 0h 30m

**Description:**
It will be done a study of the possible improvements that are considered adequate, explaining the decision. It will be elaborated a written document evaluating the options studied.

**Support materials:**
10 % of the mark

### A6 INTERVENTION PROJECT

**Hours:** 2h  
Theory classes: 2h

**Description:**
It will be done an intervention project according to the collected information in the previous activities. The intervention project must include:
- Emplacement of the building
- Descriptive and constructive memory of the building
- Consumption justification
- Management of the collected information
- Intervention proposition
- Measurements
- Budget
- Conclusions

2.- It will be included inside the project:
- The acoustic isolation (R) of the blind facades.
- Calculation of the reverberation time of the living room of the house.
- Calculation of the light in the living room of the house.

**Support materials:**
- Part 1: 30% of the mark
- Part 2: 11% of the mark
**Qualification system**

The qualification system is based on the continuous evaluation from the different activities proposed during the course, and the final qualification is the addition of these marks:

For the Module 1
- Activity 1: 11%
- Activity 2: 12%
- Activity 3: 12%
- Activity 7: 15%

TOTAL 50%

For the Module 2
- Activity 4: 5%
- Activity 5: 10%
- Activity 6: 5%
- Activity 7: 30%

TOTAL 50%

**Regulations for carrying out activities**

It is an essential condition to do all the proposed activities. The modules will be evaluated individually and it is necessary to pass each module. The realisation rules and the value of the activities are detailed in the educational guide.
Bibliography

Basic:


Others resources:

CES EduPack 2010: standard & sustainability