310076 - Energy Efficiency

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: INMACULADA RODRIGUEZ CANTALAPIEDRA
Others: ENRIQUE ALVAREZ LACALLE
Ferrando Bonet, Merce

Degree competences to which the subject contributes

Specific:
1. FB-1 Aptitude to use the applied knowledges related with the numerical and infinitesimal calculus, linear algebra, analytic and differential geometry, and the probabilistic and statistical analysis techniques and methods.
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. FB-6 Appropriate knowledge of the business concept, its institutional framework, organisation models, planning, control and strategic decision making in certainty environments, risk and uncertainty; production systems, expenses, planning, financing sources and making of financial plans and budgets.
4. FE-1 Ability to understand and make the graphical documentation of a project, to do data gathering, surveying of plans and geometric control of construction units.
5. FE-4 Knowledge of the materials and traditional or prefabricated construction systems used in construction, their varieties and physical and mechanical features which define them.
6. FE-14 Aptitude to apply the specific regulations about facilities in the construction process.

Transversal:
7. 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.
8. 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.
9. 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.
10. 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.
11. 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.
### Teaching methodology

The directed learning hours consist on the one hand in theoretical classes (big group) where the professor does a brief exposition to introduce the general learning objectives related with the basic concepts of the subject. Subsequently and by practical exercises, the professor will try to motivate and involve the students so that they can participate actively of their own learning. It is used support material in detailed teaching plan format by ATENEA: learning objectives by contents, concepts, examples, directed learning and evaluation activities programmes and bibliography. On the other hand, these learning hours also consist in doing problem classes where the students work, generally, in groups of 3 to 4 members, by the resolution of exercises and numerical problems, related with the specific learning objectives of each one of the subject contents.

In these problem sessions it is pretended to incorporate some generic competences, like the teamwork competence. For this reason cooperative learning techniques are developed at class. The last type of directed learning hours consist in doing some practices at the calculus centre, which will be done in pairs, and allow to develop basic abilities of numerical and computer type. Generally, after each session out of class tasks are proposed, which must be worked individually or in groups. There also have to be considered the other autonomous learning hours like the ones dedicated to the guided readings or the resolution of proposed problems.

### Learning objectives of the subject

At the end of the subject, the students should be able to:

- Explain the meaning of the Spanish and European energy policies.
- Determine the causes of the Global Warming.
- Explain the meaning of low energy consumption in the context of construction.
- Define energy efficiency.
- Relate everything in the context of the construction.
- Identify the design techniques and principles of the energy efficiency of the buildings.
- Use the design techniques and principles for the implementation of renewable energy systems in buildings.

### Study load

<table>
<thead>
<tr>
<th>Total learning time: 75h</th>
<th>Hours large group: 16h 30m</th>
<th>22.00%</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group: 13h 30m</td>
<td>18.00%</td>
</tr>
<tr>
<td></td>
<td>Hours small group: 0h</td>
<td>0.00%</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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</tbody>
</table>
# 310076 - Energy Efficiency

## Content

<table>
<thead>
<tr>
<th>C1 Energy, environment and weather</th>
<th>Learning time: 15h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 4h</td>
</tr>
<tr>
<td></td>
<td>Practical classes: 2h</td>
</tr>
<tr>
<td></td>
<td>Self study: 9h</td>
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</tbody>
</table>

**Description:**

**Related activities:**
There will be done the activity 1, which corresponds to a test exam of the basic concepts (20% of the mark).

<table>
<thead>
<tr>
<th>C2 Energy efficiency in buildings</th>
<th>Learning time: 41h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 12h</td>
</tr>
<tr>
<td></td>
<td>Practical classes: 8h</td>
</tr>
<tr>
<td></td>
<td>Self study: 21h</td>
</tr>
</tbody>
</table>

**Description:**

**Related activities:**
There will be done the activities 2, 3 and 4, which correspond to a practice in the calculus centre with directed learning, an individual continuous evaluation exam at class (30% + 30% of the mark) and a energy qualification with the software C3x (20% of the mark).

<table>
<thead>
<tr>
<th>C3 Principals of renewable energies</th>
<th>Learning time: 19h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td></td>
<td>Practical classes: 2h</td>
</tr>
<tr>
<td></td>
<td>Self study: 15h</td>
</tr>
</tbody>
</table>

**Description:**
## Planning of activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
<th>Support materials</th>
<th>Specific objectives</th>
<th>Hours</th>
</tr>
</thead>
</table>
| **A1 GROUP TESTS OF CONTINUOUS EVALUATION (CONTENT 1)** | Questionnaire exam about basic concepts developed in class. | Clippings and webpages about the related topics. | At the end of the activity, the students should be able to:  
- Understand the basic concepts about the world economy and in particular on energy policy.  
- Interpret qualitatively the factors which can influence the energy saving in buildings. | **11h**  
Practical classes: 2h  
Self study: 9h |
| **A2 CENTRE OF CALCULATION. USE OF THE SOFTWARE CALENER (CONTENT 2)** | Practice which must be done in the calculus centre, in pairs, with a duration of 6 hours. Using the free software LIDER and CALENER it will be introduced a building to verify the compliance of the CTE-HE1 and the energy qualification, and as directed learning it is planned that the students do a previous reading of the guide notes of the application and verify the compliance. Subsequently, the faculty will do an oral verification, making questions, to identify the learning. | Guide of the application and software link. | At the end of the practice, the students should be able to:  
- Deduce the energy improvements of the different materials and thicknesses.  
- Calculate the value of the CO2 emissions of the different proposals. | **10h**  
Practical classes: 4h  
Self study: 6h |
| **A3 INDIVIDUAL TESTS OF CONTINUOUS EVALUATION (CONTENT 2)** | Individual fulfilment at class of an exercise of the topic energy demand or heat transfer which will cover all the specific learning objectives of the topic. Correction by the faculty. | Notes of the topic available (PowerPoint) in ATENEA.  
Wording of the exercise and calculator for the realisation of the activity. | | **8h**  
Practical classes: 2h  
Self study: 6h |
A4 INDIVIDUAL TESTS OF CONTINUOUS EVALUATION (CONTENT 2) | Hours: 14h  
| Practical classes: 4h  
| Self study: 10h

**Description:**
Individually a energy qualification will be done with the software C3x.

**Support materials:**
Notes in ATENEA.

**Descriptions of the assignments due and their relation to the assessment:**
Individual project.  
It represents the 20% of the final mark of the subject.

**Specific objectives:**
At the end of the activity, the students should be able to:  
. Write correctly the text of the project.  
. Calculate the energy qualification. Amortization of the proposed improvements.

**Qualification system**

The final mark is the addition of these partial marks:
\[ N_{\text{final}} = 0.5 \times N_{\text{ac}} + 0.5 \times N_{\text{EL}} \]

- **N_{\text{final}}**: Final mark.  
- **N_{\text{ac}}**: Mark of the continuous evaluation.  
- **N_{\text{EL}}**: Mark of the lab practices (lab, computer room).

The continuous evaluation consists in doing different activities, both individually and in group, with summative and educational nature, done during the course (in and out of class).

**Regulations for carrying out activities**

If some of the continuous evaluation or lab activities is not done, it will be considered as non-marked.
Bibliography

Basic:

 Others resources:
Legislation:

Web:
http://www.codigotecnico.org
http://www.learn.londonmet.ac.uk/packages/tareb/es/index_ecb
http://www.icaen.es

Programme.
LIDER, CALENER, EnergyPlus