310074 - Energy and Construction

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 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: ANTONIO CABALLERO MESTRES
Others: ORIOL PARIS VIVIANA

Degree competences to which the subject contributes

Specific:
1. 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.
2. 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.
3. FE-7 Ability to identify the constructive elements and systems, define its function and compatibility, and its implementation to construction in the construction process. Plan and solve constructive details.

Transversal:
4. 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.
5. 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.
6. 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.
7. 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

It is pretended that the student acquires appropriate intellectual tools to be able to propose a reduction of the energy demand of the building, according to the most appropriate active systems. For this reason the percentage between practices and tutorials, and theory depends on the module.

Learning objectives of the subject

It is pretended that the student acquires appropriate intellectual tools to be able to propose a construction of low energy demand according to the architecture defined by the functional programme and the surrounding. For this reason the percentage between the practices and tutorials and the theory depends on the module.

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

. Determine criteria for the choice of active systems of environmental control.
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. Explain the meaning of a good or bad location, surrounding and use of a building depending on energy parameters.
. Use and analyze the active systems of energy catchment and using in the improvement of the energy behaviour of the building.

Study load

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

<table>
<thead>
<tr>
<th>C1 BUILDING CONSTRUCTION AND ENERGY EXCHANGE</th>
<th><strong>Learning time:</strong> 25h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 8h</td>
</tr>
<tr>
<td>In this content the students work:</td>
<td>Practical classes: 2h</td>
</tr>
<tr>
<td><strong>CONSTRUCTION AND ENERGY EXCHANGE</strong></td>
<td>Self study: 15h</td>
</tr>
<tr>
<td>1. Energy Impact of the Materials and the Construction in general, present and Future. Analysis of the main Materials which form the surrounding of the building from the Energy point of view, current situation of the present Park of buildings and immediate future.</td>
<td></td>
</tr>
<tr>
<td>2. Existing systems of surroundings and its historic evolution, current situation. Explanation of the different systems of surroundings (construction sections) and its influence in the Thermal gain, evolution.</td>
<td></td>
</tr>
<tr>
<td>4. Existing systems of Energy Exchange. Explanation of the active systems of energy catchment and use in the improvement of the energy behaviour of the building.</td>
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<tr>
<td><strong>Related activities:</strong></td>
<td>Activity 1.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C2 ACTIVE SYSTEMS. DEMAND, CONSUMPTION AND USE</th>
<th><strong>Learning time:</strong> 25h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 8h</td>
</tr>
<tr>
<td>In this content the students work:</td>
<td>Practical classes: 2h</td>
</tr>
<tr>
<td><strong>ACTIVE SYSTEMS. DEMAND, CONSUMPTION AND USE</strong></td>
<td>Self study: 15h</td>
</tr>
<tr>
<td>1. The Energy and the Exergy.</td>
<td></td>
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<tr>
<td>2. Thermal Sensation.</td>
<td></td>
</tr>
<tr>
<td>3. Introduction to the Simulation Software.</td>
<td></td>
</tr>
<tr>
<td>4. Knowledge of the available tools.</td>
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<tr>
<td>5. Climate Analysis Systems.</td>
<td></td>
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<tr>
<td>8. Thermal Balance.</td>
<td></td>
</tr>
<tr>
<td><strong>Related activities:</strong></td>
<td>Activity 2.</td>
</tr>
</tbody>
</table>
## C3 COMPUTER SIMULATIONS

<table>
<thead>
<tr>
<th>Learning time:</th>
</tr>
</thead>
<tbody>
<tr>
<td>25h</td>
</tr>
<tr>
<td>Theory classes:</td>
</tr>
<tr>
<td>2h</td>
</tr>
<tr>
<td>Practical classes:</td>
</tr>
<tr>
<td>4h</td>
</tr>
<tr>
<td>Guided activities:</td>
</tr>
<tr>
<td>4h</td>
</tr>
<tr>
<td>Self study:</td>
</tr>
<tr>
<td>15h</td>
</tr>
</tbody>
</table>

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

**COMPUTER SIMULATIONS**
1. Modelling criteria and hypothesis.
2. Interpretation of the data.

### Related activities:
Activity 3.
### Planning of activities

<table>
<thead>
<tr>
<th>A1 GROUP TESTS OF CONTINUOUS EVALUATION</th>
<th>Hours: 4h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Practical classes: 2h</td>
</tr>
<tr>
<td>In groups of 3 to 4 members and at class, there will be done an exercise when the topic CONSTRUCTION AND ENERGY EXCHANGE is finished, with a wording which will demand to apply most of the specific learning objectives of the topic. Subsequently there will be done a coevaluation between groups, with the help of a table with the correction criteria (rúbrica), while the professor corrects the exercise in the blackboard.</td>
<td>Self study: 2h</td>
</tr>
<tr>
<td><strong>Support materials:</strong></td>
<td></td>
</tr>
<tr>
<td>Self-learning questionnaire with multiple choice and notes of the topic available (PowerPoint) 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>Exercise of each one of the group members with the corresponding coevaluation and the common report of the group.</td>
<td></td>
</tr>
<tr>
<td>Return, with the corresponding feedback of the professor, during the next session and general reflection at class about the most common mistakes and the learning objectives associated which should be reinforced.</td>
<td></td>
</tr>
<tr>
<td>It represents a part of the continous evaluation 35%.</td>
<td></td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td></td>
</tr>
<tr>
<td>At the end of the activity, the students should be able to:</td>
<td></td>
</tr>
<tr>
<td>1. Define the determinants of the surrounding and the energy behaviour.</td>
<td></td>
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<tr>
<td>2. Rationalization depending on the use, functional programme, environment and energy.</td>
<td></td>
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<tr>
<td>3. Use of the existing systems of energy exchange.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>A2 INDIVIDUAL TESTS OF CONTINUOUS EVALUATION</th>
<th>Hours: 8h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Practical classes: 4h</td>
</tr>
<tr>
<td>Individual fulfilment at class of an exercise of the topic ARTIFICIAL SYSTEMS, DEMAND, CONSUMPTION AND USE which will cover all the specific learning objectives of the topic, with a wording related with some content of environmental interest or quotidian life. Correction by the faculty.</td>
<td>Self study: 4h</td>
</tr>
<tr>
<td><strong>Support materials:</strong></td>
<td></td>
</tr>
<tr>
<td>Series of self-learning with multiple choice and notes of the topic available (PowerPoint) in ATENEA.</td>
<td></td>
</tr>
<tr>
<td>Following official resolution with correction criteria (rúbrica) available by the virtual campus 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 by the students of the exercise, which the professor will return the next week corrected, so that the students can compare it with the official resolution. It represents a part of the continous evaluation, the 35%.</td>
<td></td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td></td>
</tr>
<tr>
<td>At the end of the activity, the students should be able to:</td>
<td></td>
</tr>
<tr>
<td>1. Fix the demand and the energy consumption of a building.</td>
<td></td>
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<tr>
<td>2. Relate the energy efficiency according to the building functionality.</td>
<td></td>
</tr>
<tr>
<td>3. Argue the different energy strategies for the maximum efficiency of a building.</td>
<td></td>
</tr>
</tbody>
</table>
A3 GROUP TESTS OF CONTINUOUS EVALUATION

**Description:**
Individual fulfilment at class of an exercise of the topic COMPUTER SIMULATIONS which will cover all the specific learning objectives of the topic, with a wording related with some content of environmental interest or quotidian life. Correction by the faculty.

**Support materials:**
Self-learning questionnaire with multiple choice and notes of the topic available (PowerPoint) in ATENEA.

**Descriptions of the assignments due and their relation to the assessment:**
Resolution by the students of the exercise, which the professor will return corrected the next week, so that the students can compare it with the official resolution. It represents a part of the continuous evaluation, the 30%.

**Specific objectives:**
At the end of the activity, the students should be able to:

1. To model a building to calculate the possible consumption depending on the different active systems with computer software.
2. Understand the data obtained with the programme.
3. Propose improvements to improve the energy efficiency.

**Qualification system**
As it is a continuous evaluation each module is considered with its own evaluation and this percentage:

- Module 1: 35%
- Module 2: 35%
- Module 3: 30%

**Regulations for carrying out activities**
All the exams will be done with all the material used during the course.
Bibliography

Basic:


Others resources:

Campus magazines
Audiovisual material
Informatics Material