Universidad Zaragoza

Year : 2020/21

28628 - Sustainable Construction and Energy Efficiency in Buildings

Syllabus Information

Academic Year: 2020/21
Subject: 28628 - Sustainable Construction and Energy Efficiency in Buildings
Faculty / School: 175 - Escuela Universitaria Politécnica de La Almunia
Degree: 422 - Bachelor's Degree in Building Engineering
ECTS: 6.0
Year: 4
Semester: First semester
Subject Type: Compulsory
Module: ---

1.General information

1.1.Aims of the course

By passing the subject, the student will be more competent to have:

- Organisational and planning skills Problem solving skills. Ability to make decisions.
- Ability to define the function of each of the construction elements in relation to the requirements that are demanded. Aptitude for oral and written communication of the native language.
- Analysis and synthesis capacity. Information management capacity.
- Capacity for critical thinking.
- Ability to work in an interdisciplinary team
- Ability to improvise and adapt to face new situations Leadership skills
- Positive social attitude towards social and technological innovations.
- Ability to reason, discuss and present one's own ideas
- Ability to communicate through word and image
- Ability to search, analyze and select information
- Ability to apply their knowledge to their work or vocation in a professional manner and possess the skills that are usually demonstrated through the development and defense of arguments and problem solving within their area of study.
- Ability to gather and interpret relevant data (usually within their area of study) to make judgments that include reflection on relevant social, scientific or ethical issues.
- Ability to identify the elements and construction systems, to define their function and compatibility and their implementation in the construction process. To propose and solve constructive details.
- Analyse the life cycle of construction elements and systems.
- Ability to intervene in the energy efficiency of buildings.

1.2.Context and importance of this course in the degree

The subject of Sustainable Architecture and Energy Efficiency of Buildings, is part of the Degree in Technical Architecture that EUPLA offers, and is part of the group of subjects that make up the module called Specific Training. This is a fourth year course located in the first semester and is compulsory (OB), with a teaching load of 6 ECTS credits.

This subject has an important impact on the acquisition of the skills of the degree, because it is the only compulsory subject in which the student acquires knowledge regarding the techniques of intervention in the energy efficiency of buildings, as well as in the set of installations in buildings that use different renewable energies.

The main objective of the course is based on compliance with the EU Directive 2018/844 on Nearly Zero Energy Buildings.

Among the changes of the New EU Directive 2018/844 (EPBD), the most important thing to know about this Directive is that from 2021, both new and rehabilitated buildings must not only be highly energy efficient, but must also incorporate renewable energy sources (wind turbines, photovoltaic panels, thermal...). Near Zero-Energy Buildings (nZEB) or ECCN buildings can be defined as buildings that meet a very high level of energy efficiency and comfort, which have a very low energy consumption, mostly from renewable sources on site or from the environment. "Amount of Energy Demand = Amount of Sustainable Energy Generation"

In addition, an nZEB building generates the same or more energy than it consumes, offering huge energy savings on user bills. Therefore, its zero energy balance offers economic and ecological advantages, for a great variety of climates and building typologies, being the future of sustainable construction.

The need for the course within the curriculum of this degree is therefore more than justified due to the attributions of the Technical Architects, both in the drafting of Building Rehabilitation Projects and in the Direction of Execution of the works, as well as in the collaboration in the design and study of the buildings from a bioclimatic and energy efficiency point of view.

In recent years**, energy efficiency** has become a **major objective** for both administrations and homeowners. Energy efficiency follows **three basic principles**:

- Reduction of energy demand: passive strategy, linked to the thermal envelope. Demand reduction is also achieved through proper indoor ventilation management.
- Use of installations with maximum efficiency: active strategy, considers the use of installations with the highest possible energy efficiency, taking into account that energy consumption is the result of the relationship between the building's demand and the performance of its installations.
- Use of renewable energy, meeting demand by using renewable and clean energy sources. Energy efficiency in older buildings aims to reduce energy consumption in general.

Therefore, the following are established as objectives of the course:

- To know the principles that explain energy efficiency in building.
- Analyze the characteristics and criteria on energy efficiency in the building.
- To know the different forms of energy certification seals existing in the world, PASSIVHAUS, WELL, BREEAN, GREEN...
- Analyse the sections of the CTE and other European directives that refer to energy saving and energy efficiency in building.
- To know the energy efficiency of the DHW and air conditioning installations.
- To know the energy efficiency in lighting installations.
- Analyze facilities designed under the parameters of energy efficiency.
- Calculate different energy-efficient installations.
- Analyze technical documentation of materials and elements that are part of efficient installations.
- To know the different renewable energies applied to building.
- Know what, how and why bioclimatic housing is being planned.

As a primary objective, the student must finish the term, understanding exactly what it is, how it is projected and how a building of almost zero consumption is executed.

1.3.Recommendations to take this course

Given that the subject of Sustainable Architecture and Energy Efficiency of Buildings requires a comprehensive analysis of the building's construction systems and its facilities, it is considered necessary that

the student has previously acquired knowledge in the subjects of:

- **Fundamentals of Building Materials I**
- **Building Materials I, II and III**
- **Measurements and Budgets**
- **Maintenance and Rehabilitation of Buildings**

Facilities I and II.

2.Learning goals

2.1.Competences

The subject and its expected results respond to the following approaches and objectives: To initiate the student to express himself/herself with technical and scientific rigor.

To accustom the student to reasoning, so that he/she understands why a constructive element presents an injury, reasoning and understanding by the same, in a deductive manner, the reason for the observed deficiencies.

Encourage the student's ability to observe, to provoke their ability to see, distinguishing the materials and construction techniques used.

To provoke in the student the capacity to give adequate solutions in the presence of the buildings of almost zero consumption.

2.2.Learning goals

Coherence

Through the achievement of the pertinent learning results, the necessary capacity is obtained for the understanding of the energetic processes in the buildings, deducing the origin of the problem from the study and analysis of the observed symptomatology, essential question for the accomplishment of the proposal of suitable intervention, giving rise to the recovery of the element or constructive system and according to its extension, of the building.

Through the knowledge acquired, training is acquired in the drafting of Projects and Advice for the energy rehabilitation of Buildings, and for the implementation of systems that allow energy self-sufficiency and buildings with almost zero consumption.

2.3.Importance of learning goals

Relevance

- Energy efficiency in buildings (housing sector)
- Energy efficiency Passive and active solar thermal systems
- The aim is to provide solid, although not exhaustive, information on solar thermal energy and the possibility of u sing it in buildings.
- Availability of energy at the Earth's surface and its potential for use
- Have a rough idea of how the position of the Sun is determined depending on the time of year in order to maximize solar gains in buildings. These solar gains can be applied to both active systems (water heating and heating) and passive systems.
- To have a rough idea of what type of systems are used for the use of solar energy in buildings.

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

System of continuous evaluation.

Following the spirit of Bologna, in terms of the degree of involvement and continuous work of the student throughout the course, the assessment of the subject considers the system of continuous assessment as the most appropriate to be in line with the guidelines set by the new framework of the EHEA.

The system of continuous evaluation will have the following group of qualifying activities:

To pass this course, the student must achieve a minimum overall score of 5 points out of a total of 10.

- **Activities and individual attitudes of the student**: Attendance at classes, active participation of the student, responding to the questions posed by the teacher during the daily course of the class, his fluency and oral expression when expressing in public the work and the qualification of the theoretical-practical exercises proposed and collected in situ will be taken into account.

All activities will contribute in the same proportion to the total score of that block.

Contribution to the final grade of the course 10%-20%

- **Work to be done by the student:** Throughout the course, the student will have to do several works to be solved individually or in a group of five students maximum. A part of the work will be discussed the strategy for its resolution in school time, although the completion of the work will be done by the student as part of the non-attendance activities, to take into account this note, the work should be delivered on the dates marked, and attend the group tutorials with the teacher.
- **Public exhibition of individual work.** The selected work will be presented and discussed in class. The presentation before the class will be compulsory to pass the course. It will be scored from 0 to 10 and will contribute.

As a summary of the above, the following weighting table has been designed for the grading process of the different activities in which the process of continuous assessment of the course has been structured.

Assessment activity	**Weighting**
Individual student activities and attitudes:	**10 %-20%**
Course work	**30 %-40%**
Written assessment tests	**50 %-60%**

The variation in the percentages is mainly due to the number of students enrolled or who decide to use the continuous assessment system, which must be adapted to this circumstance.

Depending on the involvement and attendance of the students, all this evaluation may be replaced, at the teacher's discretion, by continuous global work involving the entire course, which would imply no written evaluation tests.

Comprehensive final evaluation test.

For those students who do not attend, the following tests will be carried out:

- **Presentation and exposition of an individual work**

The work will be about a subject related to the subject, which each student will specify with the teacher. The teacher will supervise the student's personal work, guiding them in the search for information and in their assessment.

The work must be presented in writing on the day of the tests and then presented orally and discussed with the teacher.

It will be scored from 0 to 10 and will contribute 40% to the final grade. The assessment criteria are the same as for face-to-face students.

Contribution to the final grade of the course 40%.

- **Taking an objective test**

The test will consist of a series of questions on the theoretical contents of the subject.

The student must opt for this modality when, due to his/her personal situation, he/she cannot adapt to the rhythm of work required in the continuous assessment system, has failed or would like to increase his/her grade after having participated in this assessment methodology.

As in the previous assessment methodology, the overall final assessment test should aim to check whether the learning outcomes have been achieved, as well as to contribute to the acquisition of the various competences, if possible through more objective activities.

The overall final evaluation test will have the following group of qualifying activities:

- **Final written examination**

This will include the resolution of the theoretical questions posed, considering not only the correct resolution of the questions posed, but also the order and structure of the response, as well as the clarity of the presentation. The time period for the resolution of the examination will be between two and three hours. This test will be unique with representative exercises of the topics

In the final exam, a theoretical part and a practical part may be taken, under the criterion of the Professor of the Subject.

Contribution to the final grade of the course 60%.

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The learning process that has been designed for this subject is based on the following:

- A strong teacher/student interaction. This interaction is materialized through a division of work and responsibilities between students and teachers. However, it should be taken into account that to a certain extent students will be able to set their own learning pace according to their needs and availability, following the guidelines set by the teacher.
- The subject of Sustainable Building and Energy Efficiency of Buildings is conceived as a unique set of contents, but worked under three fundamental and complementary forms such as: the theoretical concepts of each teaching unit, the visualization of problem solving and the realization of practical work by the student. Teaching will be organized according to the following guidelines:

The learning process designed for this subject is based on the following:

- **Theory Classes:** Theoretical activities carried out mainly through exposition by the teacher, where the theoretical supports of the subject are displayed, highlighting the fundamental, structuring them in topics and or sections, interrelating them.

- **Practical Classes:** The teacher resolves practical problems or cases for demonstrative purposes. This type of teaching complements the theory shown in the lectures with practical aspects.
- **Laboratory Workshop:** The lecture group is divided up into various groups, according to the number of registered students, but never with more than 20 students, in order to make up smaller sized groups.
- **Individual Tutorials:** Those carried out giving individual, personalized attention with a teacher from the department.

Said tutorials may be in person or online.

"If classroom teaching were not posssible due to health reasons, it would be carried out on-line"

4.2.Learning tasks

This course is organized as follows:

- **Theory classes:** The theoretical concepts of the subject are explained and illustrative examples are developed as a support to the theory when necessary.
- **Practice sessions**: Problems and practical cases are carried out, complementary to the theoretical concepts studied.
- **Laboratory workshop:** This work is tutored by a teacher, in groups of no more than 20 students.
- **Autonomous work and study**
    - Study and understanding of the theory taught in the lectures.
    - Understanding and assimilation of the problems and practical cases solved in the practical classes.
    - Preparation of seminars, solutions to proposed problems, etc.
    - Preparation of laboratory workshops, preparation of summaries and reports.
    - Preparation of the written tests for continuous assessment and final exams.

4.3.Syllabus

4.4.Course planning and calendar

Programme

Proposed activities and key dates of the course.

All these programmed activities are understood to be specified for information purposes, depending on the actual dates of the school calendar.

Variations on the syllabus or the work planned may be due to the practical nature of the subject and the possibility of acting on a real case that enriches the student.

Presentation of the practical work Practical Work

Integral rehabilitation of a building from the point of view of energy efficiency.

- Theme I Introduction and policy context: **2 teaching days**
- Theme II Fundamentals of solar radiation: **3 teaching days**
- Theme III Bioclimatic Architecture **2 school days**.
- Topic IV PASSIVHAUS: **3 school days**.
- Topic V WELL, BREAM: **2 school days**

Examination of the first partial of the subject. Topics I, II, III, IV, V

- Topic VI Energy Certification: **2 school days**
- Theme VII Renewable Energy in Buildings: **2 teaching days**
- Theme VIII Infiltration and Thermography **2 teaching days**
- Theme IX Energy Rehabilitation of Buildings: **3 teaching days**

- Theme X Facilities in Building Rehabilitation: **2 school days**
- Theme XI Sustainable Urbanism: **3 school days**.

Examination of the second part of the course. Subjects VI, VII, VIII, IX, X, XI

Delivery of the practical work

Final examination of the subject.

The weekly schedule for the course can be found at www.eupla.unizar.es.

The dates of the final exams will be officially published at:
www.eupla.unizar.es/index.php/secretaria-2/informacion-academica/distribucion-de-examenes

4.5.Bibliography and recommended resources

The bibliography, is updated in the following link:

http://psfunizar10. unizar. es/br13/egAsignaturas. php?codigo=28628