Course guide
310753 - 310753 - Advanced Energy Modelling in Existing Buildings

Last modified: 17/10/2023

Unit in charge: Barcelona School of Building Construction
Teaching unit: 753 - TA - Department of Architectural Technology.

Degree: BACHELOR'S DEGREE IN ARCHITECTURAL TECHNOLOGY AND BUILDING CONSTRUCTION (Syllabus 2019). (Optional subject).

Academic year: 2023 **ECTS Credits:** 3.0 **Languages:** Spanish, English

LECTURER

Coordinating lecturer: Alfaro Garrido, Licinio José

Others: Caballero Mestres, Antonio
Paris Viviana, Oriol

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
FB-05. 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.
FB-04. 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.
FB-07. FB-7 Ability to organise small companies and take part as a member of multidisciplinary teams in big companies.

Transversal:
07 AAT N1. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.
04 COE. 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.
05 TEQ. 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.
06 URI. 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 intended that the student acquires appropiate intelectual tools to be able to propose a reduction of the energy demand of the building, according to the most appropiate active systems. For this reason the percentage between practices and tutorials, and theory depends on the module.

LEARNING OBJECTIVES OF THE SUBJECT

It is intended that the student acquires appropiate intelectual 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.
. 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

Type	Hours	Percentage
Hours large group	30,0	40.00
Self study	45,0	60.00

Total learning time: 75 h

CONTENTS

C1 BUILDING CONSTRUCTION AND ENERGETY EXCHANGE

Description:
In this content the students work:

CONSTRUCTION AND ENERGY EXCHANGE

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.
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.
3. Foundations of the Thermal Transmittance. Thermal resistance.
Explanation of the Transmittance Properties of the materials and introduction to the calculation.
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.

Related activities:
Activity 1.

Full-or-part-time: 25h
Theory classes: 8h
Practical classes: 2h
Self study : 15h

C2 ACTIVE SYSTEMS. DEMAND, CONSUMPTION AND USE

Description:
In this content the students work:

ACTIVE SYSTEMS. DEMAND, CONSUMPTION AND USE

1. The Energy and the Exergy.
2. Thermal Sensation.
3. Introduction to the Simulation Software.
4. Knowledge of the available tools.
5. Cimate Analysis Systems.
6. Thermodynamic principles, and its application in the Energy Blance, start of the Calculation of the Energy Balance.
7. Calculation of the Energy Balance.
8. Thermal Balance.

Related activities:
Activity 2.

Full-or-part-time: 25h
Theory classes: 8h
Practical classes: 2h
Self study : 15h

C3 COMPUTER SIMULATIONS

Description:
In this content the students work:

COMPUTER SIMULATIONS
1. Modelling criteria and hypothesis.
2. Interpretation of the data.
3. Computer software.

Related activities:
Activity 3.

Full-or-part-time: 25h
Theory classes: 2h
Practical classes: 4h
Guided activities: 4h
Self study : 15h

ACTIVITIES

A1 GROUP TESTS OF CONTINUOUS EVALUATION

Description:
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.

Specific objectives:
At the end of the activity, the student must be able to:

1. Define the conditions of the envelope and the energy behavior
2. Rationalization according to use, functional program, environment and energy
3. Use of existing energy exchange systems

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

Delivery:
Exercise of each one of the group members with the corresponding coevaluation and the common report of the group.
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.
It represents a part of the continous evaluation 35%.

Full-or-part-time: 4h
Practical classes: 2h
Self study: 2h

GRADING SYSTEM

As it is a continous evaluation each module is considered with its own evaluation and this percentage:

Module 1: 35%
Module 2: 35%

EXAMINATION RULES.

All the exams will be done with all the material used during the course.

BIBLIOGRAPHY

Basic:
- Köster, Helmut. Dynamic daylighting architecture : basics, systems, projects . Basel [etc.] : Birkhäuser, cop. 2004. ISBN 376436730X.
- Serra Florensa, Rafael. Arquitectura y climas . Barcelona ; México : Gustavo Gili, 1999. ISBN 9788425217678.
- Behling, Sophia; Behling, Stefan; Schindler, Bruno; Foster, Norman. Sol power : la evolución de la arquitectura sostenible . Barcelona : Gustavo Gili, cop. 2002. ISBN 9688873969.