



Universitat de Lleida

DEGREE CURRICULUM

SUSTAINABLE CONSTRUCTION

3

Coordination: BARRAU , JEROME

Academic year 2019-20

Subject's general information

Subject name	SUSTAINABLE CONSTRUCTION 3			
Code	101433			
Semester	1st Q(SEMESTER) CONTINUED EVALUATION			
Typology	Degree	Course	Character	Modality
	Bachelor's Degree in Architectural Technology and Building Construction	4	OPTIONAL	Attendance-based
	Bachelor's Degree in Mechanical Engineering	4	OPTIONAL	Attendance-based
Course number of credits (ECTS)	6			
Type of activity, credits, and groups	Activity type	PRAULA		TEORIA
	Number of credits	3		3
	Number of groups	1		1
Coordination	BARRAU , JEROME			
Department	ENVIRONMENT AND SOIL SCIENCES			
Teaching load distribution between lectures and independent student work	60 h in the classroom (40%) 90 h self employment (60%)			
Important information on data processing	Consult this link for more information.			
Language	English			
Distribution of credits	Dr. Jérôme Barrau: 7.2 credits			
Office and hour of attention	with appointment			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
BARRAU , JEROME	jerome.barrau@udl.cat	2,4	
LAGUNA BENET, GERARD	gerard.laguna@udl.cat	4,8	

Subject's extra information

Subjects to be taken in the 1st semester of the 4th year of teaching. It belongs to the module "Optional Training", specifically in the subject "Sustainable Construction".

The course is based on the Spanish legislation on the limitation of demand and consumption of buildings (Technical Building Code, Basic Document saving: CTE-DB-HE) and energy certification of new and existing buildings. The tools used for the practical sessions in the computer room are the official ones in Spain. Thus, the course is aimed at achieving the skills that will enable, in the current job market, the development of different tasks related to the energy efficiency of buildings, some of which are mandatory for the real estate market.

We suggest you the joint realization of Sustainable Construction 2 (Buildings Energy Almost Nul·la- NZEB for its acronym in English), due to the complementarity of the tools used in this subject in terms of the evaluation and optimization of the energy efficiency of buildings. The project that should be done for this course can be done in conjunction with the one of Sustainable Construction 2.

You can find educational materials and other documents related to the subject on the Virtual Campus: <http://cv.udl.cat>

Learning objectives

- Assess the main parameters that affect the energy efficiency of buildings.
- Know the different standards of sustainable construction and the differences between national regulations on energy efficiency in buildings.
- Interpret the main concepts related to energy certification and energy audits.
- Apply the state, regional and local rules and regulations.
- Know and use the tools to study the improvement of energy efficiency of buildings.
- Take measurements to analyze the energy efficiency of buildings.
- Develop procedures for energy rating and energy audits of buildings.
- Generate documents of energy certification of buildings from government programs.

Competences

Strategic competences of UdL

- UdL2 Command of a foreign language.

Cross-disciplinary competences

- EPS3. Capacity to convey information, ideas, problems and solutions to both a specialized and no specialized public.
- EPS7. Capacity to work in situations with a lack of information and/or under pressure.
- EPS8. Capacity of planning and organizing the personal work.
- EPS9. Capacity for unidisciplinary and multidisciplinary teamwork.
- EPS13. Capacity to consider the socioeconomic context as well as the sustainability criteria in engineering solutions.

Specific competences

- GEE12. Manufactured or traditional constructive systems and materials knowledge, its varieties and physics and mechanical characteristics that define them.
- GEE13. Capacity to adapt the materials of construction to the typology and use of buildings; manage the reception and the quality control of the materials, its use in the building works, the execution control of the units of work and the performance of tests and final proofs.
- GEE20. Knowledge of the environmental impact evaluation for building and demolition process, of sustainability in buildings, and of the procedures and techniques to determine the energy efficiency in buildings.
- GEE21. Capacity to apply technical rules to the building process, and produce documents of technical specification of the procedures and constructive methods of buildings.

Subject contents

Unit 1. INTRODUCTION

- 1.1. Comfort and energy
- 1.2. Energy and Environment
- 1.3. Residential Sector
- 1.4. Environmental assessment of buildings

Unit 2. ENERGY EFFICIENCY

- 2.1. Definition
- 2.2. Regulations
- 2.3. Energy certificates
- 2.4. Energy audits
- 2.5. Standards of energy efficient buildings

Unit 3. PARAMETERS AFFECTING THE ENERGY PERFORMANCE OF BUILDINGS

- 3.1. Classifications
- 3.2. Parameter Description

Unit 4. MEASUREMENT TECHNIQUES FOR THE ANALYSIS OF THE ENERGY BEHAVIOUR OF A BUILDING

- 4.1. Thermography
- 4.2. Thermal equipment measurements
- 4.3. Electrical equipment measurements
- 4.4. Analysis by thermal flow meters
- 4.5. Renovations and infiltration measurements
- 4.6. Monitoring

Unit 5. ENERGY AUDITS

- 5.1. Introduction
- 5.2. Procedure to conduct an energy audit
- 5.3. Relationship between energy audits (EN 216 501), control and regulation systems (UNE EN 15232) and energy management systems (UNE 216301)
- 5.4. Criteria for evaluating proposals for improvement
- 5.5. Examples

Unit 6. BASIC DOCUMENT OF ENERGY SAVING (DB-HE); THE TECHNICAL BUILDING CODE

- 6.1.DB-HE0: Limitation of energy consumption
- 6.2.DB-HE1: Limitation of energy demand

- 6.3. DB-HE2: Efficiency of thermal installations
- 6.4. DB-HE3: Energy efficiency of lighting installations
- 6.5. DB-HE 4: Minimum solar contribution to hot water
- 6.6. DB-HE 5: Minimum PV contribution to electricity
- 6.7. Relationship between the DB-HE and reducing the environmental impact of building

Unit 7. ENERGY CERTIFICATION

- 7.1. Introduction
- 7.2. Procedure for energy certification of buildings
- 7.3. Scale and energy indicators of the grade
- 7.4. Specifics of the software CALENER GT
- 7.5. Other tools for building simulations

Methodology

The main methodology of the course will be divided into:

- 1.-Sessions of theoretical lectures, where the teacher will expose theoretical concepts required for the acquisition of knowledge and for the proper conduct of the practical sessions.
- 2.-Problem sessions, where the teacher will make some examples, but where the students will take an active part in the learning process, by working in small groups or individually.
- 3.-Laboratory sessions, where the students will work in group some practices related to the topics covered in the theoretical sessions.

Development plan

Week	Methodology	Content	Classroom hours	Independent work hours	Professor
1-2	Lecture	Unit 1. INTRODUCTION Unit 2. ENERGY EFFICIENCY	6	6	J.Barrau
2-7	Lecture Problems	Unit 3. PARAMETERS AFFECTING THE ENERGY PERFORMANCE OF BUILDINGS	20	30	J.Barrau
7-8	Lecture Laboratory sessions	Unit 4. MEASUREMENT TECHNIQUES FOR THE ANALYSIS OF THE ENERGY BEHAVIOUR OF A BUILDING	6	10	J.Barrau
9	Evaluation: Written exam				J.Barrau
10	Lecture Problems	Unit 5. ENERGY AUDITS	4	6	J.Barrau
11	Lecture	Unit 6. BASIC DOCUMENT OF ENERGY SAVING (DB-HE); THE TECHNICAL BUILDING CODE	2	4	J.Barrau
11-13	Laboratory sessions	Unit 6. BASIC DOCUMENT OF ENERGY SAVING (DB-HE); THE TECHNICAL BUILDING CODE	10	20	J.Barrau
14-15	Laboratory sessions	Unit 7. ENERGY CERTIFICATION	8	14	J.Barrau

Week	Methodology	Content	Classroom hours	Independent work hours	Professor
16-17	Evaluation				J.Barrau
18-19	Recovery				J.Barrau

Evaluation

Objectives	Evaluation Activities	Criteria	%	Dates	O/V(1)	I/G(2)	Observations
Units 1-4	Written exam (PA1)	(*)	40	Week 9	O	I	
Unit 5	Project Energy Demand limitation and Energy Certification (AA1)	(**)	30	Weeks 11-15	O	G	The activities will be delivered at the proposed date
Units 6-7	Project Energy Audit (AA2)	(**)	15	Weeks 11-15	O	G	The activities will be delivered at the proposed date
Units 5-6-7	Oral presentation Projects AA1 & AA2 (AA3)	(**)	15	Week 17	O	G	
Recovery PA1	Written exam (PA3)		40	Week 19	O	I	
Recovery AA1 & AA2	Project		45	Week 19	O	G	The activities will be delivered at the proposed date

(1) Obligatory / Voluntary.

(2) Individual / Group.

(*) This test (40% of the final grade) is divided into two sections:

- Concepts: 50% Note: Minimum mark of 5/10 in this section
- Problems: 50% Note.

(**) These evaluation activities, carried out in group, represent 60% of the final grade, with the following distribution:

- 30% relative to the works on Energy demand limitation, Energy Consumption limitation and Energy certification (AA1)
- 15% relative to the energy audit works (AA2)
- 15% relative to the evaluation of the Oral presentation of activities AA1 & AA2 (AA3)

Bibliography

Eficiencia energética en edificios: Certificación y auditorías energéticas. Francisco Javier Rey Martínez, Eloy Velasco Gomez. Madrid. Thomsoncop., 2006.

Análisis y gestión energética de edificios: métodos, proyectos y sistema de ahorro energético. William H. Clark II. Mac Graw Hill. 1998.

Guías Técnicas para la Rehabilitación de la Envolvente Térmica de los Edificios. Asociación Nacional de Industriales de Materiales Aislantes (ANDIMA). 2007.

Els graus-dia de calefacció i refrigeració de Catalunya. Resultats a nivell municipal. Generalitat de Catalunya. Departament de Treball, Indústria, Comerç i Turisme. Institut Català d'Energia. 2003

Institute for Energy Diversification and Saving, IDAE. <http://www.idae.es/>

Building Technical Code (SPAIN) <http://www.codigotecnico.org/>

Sustainable Construction Webpage <http://www.csostenible.net/>

Passivhaus SPAIN <http://www.plataforma-pep.org/>