



Universitat de Lleida

DEGREE CURRICULUM

SUSTAINABLE CONSTRUCTION

2

Coordination: BARRAU , JERÔME

Academic year 2016-17

Subject's general information

Subject name	SUSTAINABLE CONSTRUCTION 2			
Code	101432			
Semester	1st Q(SEMESTER) CONTINUED EVALUATION			
Typology	Degree	Course	Typology	Modality
	Bachelor's Degree in Architectural Technology	4	OPTIONAL	Attendance-based
	Bachelor's Degree in Building Engineering	4	OPTIONAL	Attendance-based
	Bachelor's Degree in Mechanical Engineering	4	OPTIONAL	Attendance-based
ECTS credits	6			
Groups	1GG			
Theoretical credits	2			
Practical credits	4			
Coordination	BARRAU , JERÔME			
Department	INFORMATICA I ENGINYERIA INDUSTRIAL,MEDI AMBIENT I CIENCIES DEL SOL			
Teaching load distribution between lectures and independent student work	60 h of classroom work(40%) 90 h of independent student work (60%)			
Important information on data processing	Consult this link for more information.			
Language	English			
Distribution of credits	Dr. Jérôme Barrau: 3.6 credits			
Office and hour of attention	By appointment			

Professor/a (s/es)	Adreça electrònica professor/a (s/es)	Crèdits	Horari de tutoria/lloc
BARRAU , JERÔME	jerome.barrau@udl.cat	3,6	Monday, from 11 am to 1pm, CREA 0.16
SOLE GARRIGÓS, ARAN	aran.sole@diei.udl.cat	3,6	

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".

Requirements: 1 SUSTAINABLE CONSTRUCTION

We suggest you the joint realization of Sustainable Construction 3 (Procedures on the energy efficiency of buildings in relation to Spanish law) due to the fact that it deals with complementary tools in this course in terms of evaluation and optimizing the energy efficiency of buildings. The project can be done for this course can be done in conjunction with the one of Sustainable Construction 3.

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

According to Directive 2010/31 / EU of the European Union, all new buildings must be, in 2020, Near-Zero Energy Buildings (NZEB). Consequently, the energy demand of buildings should be reduced and energy consumption should be supplied by the same building through renewable energy generation systems.

This course is aimed at achieving the necessary skills for the development of the activity of the Engineer and Technical Architect in relation to such buildings. Therefore, following the procedure of designing a building NZEB, the course is structured in two parts:

1- Passive design of the building: The purpose of this section is to minimize the energy demand of the building, by optimizing the design parameters (thermal insulation, orientation, shade elements ...). This optimization is done mainly through the free tool for energy assessment of buildings *EnergyPlus*, developed by the *U.S. Department of Energy Office Building Technologies*, and internationally recognized.

2. Active Renewable Systems. The aim here is to approach and size the renewable energy systems, applicable to buildings, to meet the energy demands of the building. In this section, we will work specifically on solar thermal and photovoltaic energy, but also on other technologies that can be applied to buildings.

Finally, due to the fact that many international construction standards include not only energy aspects but also considerations about the environmental impacts (eg Minergie, LEED ...), we will dedicate part of the subject to the achievement of competencies in the field of Life Cycle Analysis (LCA).

Learning objectives

- Understand and apply the regulations.
- Develop Life Cycle Assessment of buildings.
- Analyze behaviors of buildings using energetic simulation programs
- Identify and evaluate proposals for improvement of buildings
- Develop sizing of renewable energy systems for buildings
- Advising on the main services offered by home automation systems and control and regulation.
- Interpret the main concepts related to home automation systems and control and regulation.

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. NZEB, *European Directive 2010/31/UE*

1.2. Net balance

Unit 2. BUILDING SIMULATION SOFTWARE: *How to reduce the Energy consumption of the buildings?*

Pack: Google Sketch-up + Open Studio + EnergyPlus

Unit 3. RENEWABLE ENERGY FOR BUILDINGS: *How to cover the low Energy Consumption by on-site renewable energy?*

3.1. Solar PV systems

3.2. Solar Thermal systems

3.3. Other technologies

3.4. Control and regulation systems (Domotics & SCADAs)

Unit 4. LIFE CYCLE ASSESSMENT. *How to assess the environmental impact of buildings?*

Methodology

The main methodology of the course is 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	Lecture	Unit 1. INTRODUCTION	4	6	J.Barrau
2-7	Laboratory sessions	Unit 2. .BUILDING SIMULATION SOFTWARE	24	39	J.Barrau
8	Lecture	Unit 3. RENEWABLE ENERGY FOR BUILDINGS	4	6	L.Cabeza
9	Evaluation				J.Barrau
10-12	Laboratory sessions	Unit 3. RENEWABLE ENERGY FOR BUILDINGS	12	21	A.Solé
13-15	Lecture Problems	Unit 4. LIFE CYCLE ASSESSMENT	12	18	A.Solé
16-17	Evaluation				A.Solé L. Cabeza
18-19	Recovery				J.Barrau A.Solé L. Cabeza

Evaluation

Objectives	Evaluation Activities	Criteria	%	Dates	O/V(1)	I/G(2)	Observations
Blocs 1-2	Project EnergyPlus (AA1)	(*)	40	Week 9	O	G	The activities will be delivered at the proposed date
Bloque 3	Project Renewable Energy (AA2)	(**)	30	Week 14	O	G	The activities will be delivered at the proposed date

Objectives	Evaluation Activities	Criteria	%	Dates	O/V(1)	I/G(2)	Observations
Bloque 4	Project LCA (AA3)	(**)	10	Week 14	O	G	The activities will be delivered at the proposed date
Bloques 1-4	Oral presentation Projects AA1 & AA2 & AA3 (AA4)	(***)	20	Week 15	O	G	
Recovery AA1 a AA3	Project		80	Week 19	O	I	The activities will be delivered at the proposed date

(1) Obligatory / Voluntary.

(2) Individual / Group.

(*)

- Continued work
- Delivered files
- Originality and realism of the proposals
- Quality of the report and conclusions
- Program Control

(**)

- Continued work
- Originality and realism of the proposals
- Quality of the report and conclusions

(***)

- Presentation quality
- Presentation and analysis of the results

Bibliography

Domótica e Inmótica. Viviendas y Edificios Inteligentes. Cristóbal Romero Morales, Franciso Vazquez Serrano, Carlos deCastro Lozano. Madrid Ra-MA cop. 2006.

National Renewable Energy Laboratory (NREL) <http://www.nrel.gov/>

EnergyPlus Website <https://energyplus.net/>

Beckman, William A.; Proyecto de sistemas térmico-solares por el método de las curvas- f. / por William A. Beckman, Sanford A. Klein, John A. Duffie ; Laboratorio de Energía Solar de la Universidad de Madison, Wisconsin; Madrid 1982