66344 - Energy efficiency in buildings

Información del Plan Docente

Academic Year	2016/17
Academic center	110 - Escuela de Ingeniería y Arquitectura
Degree	535 - Master's in Renewable Energies and Energy Efficiency 330 - Complementos de formación Máster/Doctorado
ECTS	5.0
Course	XX
Period	Half-yearly
Subject Type	ENG/Complementos de Formación, Optional
Module	---

1.Basic info

1.1.Recommendations to take this course

1.2.Activities and key dates for the course

2.Initiation

2.1.Learning outcomes that define the subject

2.2.Introduction

3.Context and competences

3.1.Goals

3.2.Context and meaning of the subject in the degree

3.3.Competences

3.4.Importance of learning outcomes

4.Evaluation

5.Activities and resources

5.1.General methodological presentation

The teaching-learning process is structured in four main activities: lectures, classes for problem solving, computer practices, and development of tutored works, with increasing level of student participation.

In the **theory sessions** the basics are explained and interrelated, solving short exercises on the board. This serves as support to assure the understanding of the concepts explained. The methodology used for these sessions are master classes.

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The **practical sessions** consist of computer sessions in which more complex practical cases than those presented on the board are studied. Thus, these practical sessions reinforce and complete the contents developed during the theory sessions. In these sessions, several cases will be solved through the use of various computer tools, with the support and help of the teacher. Students will have a script of each practice, which they will have previously read and prepared.

The **tutored works** will be individually made by each student, as an expansion of the practical sessions, solving larger problems than solved in practical sessions. Thus, the autonomous learning of the students is encouraged. Students will be provided with the necessary tools for the development of these works. Although the work to be performed is intended as a distance learning activity, it will be presented during the in-person classes. These tutored works will be supervised by the teacher, who will resolve any doubts that may arise during its development.

In **tutorial sessions** , the students can voluntarily attend to the teacher office in order to ask questions about the subjects' contents. There will be a tutorial timetable for these sessions. The use of these tutorial sessions is highly recommended to ensure adequate progress in the learning process.

5.2.Learning activities

1: Lectures: will be held at 2 weekly sessions lasting two hours each. In this activity the fundamental contents of the subject are explained and some practical exercises are solved. The most representative and relevant exercises are selected to be solved in order to facilitate understanding and contents' assimilation. Student participation in the resolution process is intended. This activity takes place in-person classes.

2: Practical sessions: These sessions are essential in order to assure a correct application of the theoretical concepts presented in lectures. A total of 3 sessions will be planned in a computer room. At the beginning of the course a preliminary schedule of the practical sessions will be presented. This schedule can be slightly modified according to the program's progress and the availability of computer rooms.

3: Visits: Depending on the availability of students, some visits can be planned to the Sustainable Urban Centre in Ecociudad Valdespartera, to the CIEM building in Milla Digital and to the CIRCE building in Campus Rio Ebro.

5.3.Program

The program of this subject includes the next contents:

Unit 1. Introduction: building and sustainability.

Unit 2. Definition of the constructive elements in the thermal envelope of a building. Thermal transmittance and thermal bridges.

Unit 3. Analysis of regulations on energy efficiency in buildings: Technical Building Code - Basic Document of Saving of Energy. Limits on energy consumption and thermal demand in buildings (HE0 and HE1), energy efficiency in heating, ventilation and air conditioning -HAVC- systems (HE2), energy efficiency in lighting (HE3), integration of solar thermal energy in buildings (HE4).

Unit 4. Energy balance in a building: heat losses and gains. Calculation of the thermal demand of a building.

Unit 5. Energy certification of buildings. Calculation of the energy rating of a building: Use of the unified tool

LIDER-CALENER - solving of practical examples.

Unit 6. Bioclimatic architecture and passive strategies for energy savings in buildings: shape and orientation, climate adaptation, thermal comfort, microclimates, thermal insulation, openings (windows), thermal storage, ventilation, passive heating / cooling, natural lighting, Passive House standard.

Unit 7. Energy Simulation of Buildings: basic concepts. Use of DesignBuilder: geometric definition, thermal demand calculation, improvements' assessment in the buildings envelope. Solving practical examples of energy refurbishment of buildings.

Unit 8. Measuring equipment for buildings: Light-meter, network analyser, clamp meter, thermal imaging camera, thermal transmittance measurement, combustion gas analyser and blower door.

Unit 9. Sustainable building - life-cycle assessment: general methodology, application to products, constructive solutions (EPD) and buildings. Basic principles of bioconstruction.

Unit 10. Methodologies for environmental rating and certification of buildings: LEED and VERDE. Basic principles and assessment indicators. Certification Guides and practical exercises.

Unit 11. Sustainable Urban design: basic concepts.

The program for the practical sessions of the subject is as follows:

Practice 1. Using the unified tool LIDER-CALENER (4 sessions of 2 hours each: 8 hours in total).

Practice 2. Using the building energy simulation tool DesignBuilder (4 sessions of 2 hours each: 8 hours total).

Practice 3. Using the design support tool HADES and assessment of criteria in VERDE certification scheme (1 session of 2 hours).

5.4.Planning and scheduling

The reports for the tutored work must be submitted before the final written exam date, which will take place in the corresponding official calls.

In order to know the staring date of the course, the schedules of in-person classes, as well as the examination sessions, please visit the EINA website.

5.5.Bibliography and recomended resources

During the course, communication between the student and the teacher is managed thought the Moodle2 platform of the University of Zaragoza (http://moodle2.unizar.es). In this platform the teacher shares the main training materials (notes, questions, problems, previous exams, tables, etc.), and makes some announcements and notifications to students. He also sends and receives emails and offers students online tools for sending reports, works, etc.

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Basic reference documents for the course are as follows:

- Gobierno de España - Ministerio de Fomento. Código Técnico de la Edificación - Documento Básico de Ahorro de Energía. Actualización Septiembre de 2013. Disponible en .
- Gobierno de España - Ministerio de la Presidencia. Reglamento de Instalaciones Térmicas en Edificios, Actualización Abril de 2013. Disponible en < www.minetur.gob.es>.
- Turégano JA, Velasco MC, Martínez A. "Arquitectura bioclimática y urbanismo sostenible (Serie Energías renovables). Editorial Prensas Universitarias de Zaragoza. Colección Textos Docentes: Tecnológicas, 170; 2009.
- Aranda A, Zabalza I, Díaz S, Llera E. "Eficiencia energética en instalaciones y equipamientos de edificios" (Serie Eficiencia energética). Editorial Prensas Universitarias de Zaragoza. Colección Textos Docentes: Tecnológicas, 177. ISBN: 978-84-92774-96-8; 2010.
- Zabalza I,Díaz S, Aranda A. "Metodologías de análisis para la Calificación Energética de Edificios" (Serie Eficiencia Energética). Editorial Prensas Universitarias de Zaragoza. Colección Textos Docentes: Tecnológicas, 189. ISBN: 978-84-15031-79-6; 2010.
- Zabalza I, Aranda A. "Ecodiseño en la edificación" (Serie Eficiencia energética). Editorial Prensas Universitarias de Zaragoza. Colección Textos Docentes: Tecnológicas, 196. ISBN: 978-84-15274-16-2; 2011.
- Aranda A, Zabalza I. "Ecodiseño y análisis de ciclo de vida" (Serie Eficiencia energética). Editorial Prensas Universitarias de Zaragoza. Colección Textos Docentes: Tecnológicas, 178. ISBN: 978-84-92774-96-8; 2010.

Other reference books are:

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- COLEGIO OFICIAL DE ARQUITECTOS DE CATALUNYA (Programa LIFE), La Enseñanza de la Arquitectura y del Medio Ambiente, Barcelona 1997.
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