Universidad Zaragoza

Year : 2019/20

66335 - Energy efficiency

Syllabus Information

Academic Year: 2019/20
Subject: 66335 - Energy efficiency
Faculty / School: 110 -

Degree: 330 - Complementos de formación Máster/Doctorado
535 - Master's in Renewable Energies and Energy Efficiency

ECTS: 8.0
Year: 535 - Master's in Renewable Energies and Energy Efficiency: 1
330 - Complementos de formación Máster/Doctorado: XX

Semester: 330 - First semester
535 - First semester
535 - First semester
535 - First semester
Subject Type: 535 - Compulsory
330 - ENG/Complementos de Formación
Module: ---

1.General information

1.1.Aims of the course

1.2.Context and importance of this course in the degree

1.3.Recommendations to take this course

2.Learning goals

2.1.Competences

2.2.Learning goals

2.3.Importance of learning goals

3.Assessment (1st and 2nd call)

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

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The methodology followed in this course is oriented towards achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as lectures, problem-solving activities, computer practice sessions and guided assignments.

In the **lectures** the basic concepts are explained and interrelated with short exercises on the board. This serves as support to assure the understanding of the concepts explained.

The **practice sessions** consist of computer sessions in which practical cases more complex than those presented on the board are studied. Thus, these sessions reinforce and complete the contents developed during the lectures. 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 be provided with instructions for each practice session, which they will have previously read and prepared.

The **guided assignments** are an expansion of the practice sessions, in which student solve larger problems than those done in the practice sessions. Thus, the autonomous learning of the students is encouraged. Students will be provided with the necessary tools for the development of these tasks. On the one hand, one assignment will be considered on the topic of thermal energy efficiency, related to a cogeneration system. On the other hand, a few brief assignments will be required on the topic of electrical energy efficiency.

In **tutorials**, the students can voluntarily attend to the teacher's office during office hours in order to ask questions about the course contents. Its use is highly recommended to ensure adequate progress in the learning process.

4.2.Learning tasks

The course includes the following learning tasks:

- A01 Lectures (40 hours). Presentation of theoretical contents by a faculty or by external experts to all students enrolled in the course. Although it is not a mandatory activity, regular attendance is highly recommended.
- A02 Problem and case solving (20 hours). Solve practical problems and exercises with all the students. Although it is not a mandatory activity, regular attendance is highly recommended.
- A03 Laboratory sessions (20 hours). Students will work actively in groups to solve practical exercises.
- A06 Guided assignments (32 hours). Students will complete assignments, problems and exercises related to concepts seen in laboratory sessions and lectures.
- A07 Autonomous work (80 hours). Students are expected to spend about 80 hours to study theory, solve problems and prepare lab sessions
- A08 Assessment (8 hours).

The indicated hours are for guidance and will be adjusted depending on the academic calendar.

At the beginning of the course, lecturers will communicate the schedule of practice sessions, which will be set according to the syllabus and the availability of laboratories and computer rooms.

4.3.Syllabus

The course will address the following topics:

SECTION 1. THERMAL SYSTEMS ENGINEERING (5 ECTS)

TOPIC 1. COMBUSTION TECHNOLOGY AND ITS APPLICATIONS

- Basic Thermodynamics (supplementary material).
- Mass and energy balance in combustion.
- Boilers. Classification and types. Fuels.
- Thermal efficiency in boilers. Calculations and methods.
- Energy saving in boilers.
- Energy saving in boilers. Industrial experiences.

TOPIC 2. THERMAL INSULATION

- Insulation materials.
- Economic optimization of insulation thickness.
- Insulation application and protection.

TOPIC 3. HEAT EXCHANGER NETWORKS

- Heat carrying medium.
- Pumping devices.
- Ducts, valves and ancillary devices.
- Design and optimization of heat exchanger networks.

TOPIC 4. COOLING

- Cooling technologies depending on applications.
- Basic engineering in cooling installations.
- Refrigerants to use in cooling technologies.

TOPIC 5. POWER GENERATION

- Introduction to thermal turbomachinery: turbines and compressors.
- Integration of thermal machinery in power generation systems: steam cycles, gas turbines, internal combustion engines, fuel cells...

TOPIC 6. ENERGY EFFICIENCY IN BUILDINGS

1. Fundamentals and Energy Performance Certification Regulations

- Certification procedures for new and existing buildings: general and simplified options.
- Rating scale and energy indicators.
- Basics of energy efficiency in buildings.

2. Simplified Methodology for Energy Performance Certification of Existing Buildings - CE3X
- General data.
- Definition of the thermal envelope and installations.
- Rating and assessment of improvements.
- Economic analysis and solution of practical exercises: residential, small and large tertiary buildings.

3. Energy Audits in Buildings
- Identification of thermal and electrical energy consumptions.
- Measurement and quantification of energy consumption. Energy flows diagram.
- Energy Billing.
- Techniques for the development and presentation of an energy audit.
- UNE 216501and UNE-EN 16247-2 - Energy Audits.

SECTION 2. ELECTRICAL ENGINEERING (3 ECTS)

TOPIC 1. Energy Efficiency in electrical systems
- Introduction
- Definitions
- Current situation of the Energy Efficiency in electrical systems
- Mechanisms of electrical losses

TOPIC 2. Efficiency in generation systems and in power lines
- Efficiency in power generation
- Efficiency in transport lines
- Efficiency in distribution systems
- Efficiency in inner lines
- Inefficiencies and non-active component of the current
- Power factor compensation
- Demand side management and supply side management

TOPIC 3. Efficiency in electrical machines
- Efficiency in design of electrical motors
- Efficiency in adjustable speed drives
- Efficiency in power Transformers

TOPIC 4. Efficiency in lighting systems, domestic appliances and other electric equipment

4.4.Course planning and calendar

Reports of assignments must be submitted before the final written exam date, which will take place in the corresponding official calls.

Further information concerning the timetable, classroom, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the EINA website.

4.5.Bibliography and recommended resources