

66365 - Energy optimization

Syllabus Information

Academic year: 2023/24

Subject: 66365 - Energy optimization

Faculty / School: 110 - Escuela de Ingeniería y Arquitectura

Degree: 636 - Master's in Renewable Energies and Energy Efficiency

ECTS: 6.0

Year: 1

Semester: Second semester

Subject type: Optional

Module:

1. General information

This subject provides the fundamental principles for understanding, designing, selecting and operating energy equipment and installations, as well as their optimal integration in the residential-commercial sector, energy-intensive industries and energy systems. It enables students to understand and use to advantage the specialized publications on control and design of energy systems. It deepens the methodology of analysis, simulation, design and energy, economic and environmental optimization of simple and advanced thermal installations in the residential-commercial sector, energy-intensive industries and energy systems.

These approaches and objectives are aligned with the Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda: 7.2 and 7.3 (SDG 7); 8.4 (SDG 8); 9.4 and 9.5 (SDG 9); 12.2 (SDG 12).

2. Learning results

To know the energy sources, thermodynamic properties and physical-chemical phenomena that occur in energy installations.

To propose, develop and solve models for energy transformation processes. To manage process and energy system simulation programs.

To adequately apply thermodynamic and economic concepts in the design and operation of energy processes.

To know the mathematical programming techniques and their application to the optimization of the operation and design of energy processes.

To know the methods of energy integration and their application to the optimal synthesis of energy facilities.

To know the fundamentals, methods and criteria used in energy management.

3. Syllabus

- Physical fundamentals. Modelling and simulation of energy systems.
- Energy integration. Optimal heat recovery. Heat pumps and refrigeration machines. Accumulation of heat and cold. Use of renewable energies.
- Exergetic analysis. Diagnosis of equipment and plant operation.
- Economic fundamentals. Economic evaluation principles and criteria. Introduction to thermoeconomics. Thermoeconomic and life cycle analysis of energy systems.
- Mathematical programming. Optimality conditions and their economic significance.
- Optimization techniques and programs. Optimal design of equipment and plants. Process synthesis. Polygeneration systems.

4. Academic activities

This is a subject of 6 ECTS, which is equivalent to 150 hours of student work, which will be distributed in the following activities:

- Theory master classes: 30 hours.
- Problem and case solving classes: 15 hours
- Simulation and laboratory practices: 15 hours
- Tutored autonomous work: 20 non face-to-face hours
- Self-study and tutoring: 60 non-face-to-face hours
- Assessment: 10 hours

5. Assessment system

Continuous assessment

1. Problem solving and case studies of thermal installations in energy systems (components, functioning, constructive aspects, design and operation). By means of specialized computer tools, the student learns to solve diagnostic problems of the operation and advanced design of the facilities.
2. Tutored work. The student, with the guidance of the teacher, analyses the state of the art, solves complex problems and delivers a report of results.
3. Public exhibition of one of the tutored works and discussion with the teachers.
4. Final exam.

The grade for the subject will be calculated according to the following formula:

$$\text{Note} = 1/3P + 1/3(T+E) + 1/3EF$$

Where P is the grade for the practical sessions (assessment activity 1), T is the grade for the tutored work (assessment activity 2), E is the grade for the presentation (assessment activity 3) and EF is the grade for the final exam (assessment activity 4).

Global assessment.

Those students who do not wish to follow the continuous assessment will be evaluated through a final exam of the whole subject at the end of the term according to the exam calendar established by the centre.

In the second call, only the global assessment system will be followed.