66427 - Design of thermal systems

Información del Plan Docente

Academic Year	2017/18
Faculty / School	110 - Escuela de Ingeniería y Arquitectura
Degree	536 - Master's in Mechanical Engineering
ECTS	4.5
Year	1
Semester	Second semester
Subject Type	Optional
Module	---

1.General information

1.1.Introduction

This is an optional course of the module "Advanced design of energy plants" (second semester) of the Master's program in Mechanical Engineering. Its main objective is to provide students with the required skills and tools to analyze, sizing, select and improve conventional and advanced thermal devices and energy plants. The applications are focused both on the scientific and technological aspects as well as on economic and environmental issues.

1.2.Recommendations to take this course

1.3.Context and importance of this course in the degree

1.4.Activities and key dates

2.Learning goals

2.1.Learning goals

2.2.Importance of learning goals

3.Aims of the course and competences

3.1.Aims of the course

3.2.Competences

4.Assessment (1st and 2nd call)

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

5.Methodology, learning tasks, syllabus and resources

5.1.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:

1. **Lectures**, given to the entire group, in which the teacher will explain the basic principles of the course and solve some representative problems of implementation in real cases. Student participation and autonomous work will be encouraged.

2. **Practice sessions**. Computer simulations and laboratory sessions are distributed throughout the semester and its assessment will form part of the final grade of the course.

3. **Assignment**. Critical analysis of the state of the art of equipment and advanced energy systems. Application of specialized software tools for the analysis, design and/or operation of equipment and advanced energy systems.

4. **Tutorials**. The teacher will solve student's doubts. Mandatory tutorials for monitoring case studies and the assignment will be scheduled.

5.2.Learning tasks

The course includes the following learning tasks:

- Lectures (type T1). They will present the theoretical concepts, basic equipment, and thermal installations and their application in advanced energy production systems. The syllabus includes:
  - Energy sources. renewable and non-renewable energy in heating installations.
  - Sources specializing in advanced equipment and systems for energy production information.
  - Thermal solar energy. solar thermal installations. Applications in industry and buildings.
  - Advanced technologies for electricity production. Solar Thermal Power. clean coal. Fuel cells and hydrogen.
  - Advanced systems cogeneration and polygeneration. energy recovery from waste.
  - Distributed generation. District heating and cooling. Energy storage.
  - Evaluation and optimization of energy systems. Energy, economy and sustainability
- Laboratory Practice Sessions (type T3).
- Assignments (T6 type). The students will do an individual assignment on a topic proposed by the teacher throughout the semester. With some regularity, the teacher will schedule tutoring sessions in order to keep track of its progress.

5.3.Syllabus

The course will address the following topics:

1. Energy resources. Renewable and conventional energy resources in thermal plants.
2. Specialized sources of technical information for devices and advanced energy systems.
3. Solar thermal energy. Solar thermal energy plants. Applications to the industry and to the residential-commercial sector.
4. Advanced power plants. Thermoelectric Solar. Clean coal technologies. Fuel cells and hydrogen.
5. Advanced cogeneration and polygeneration systems. Waste to energy.
6. Distributed generation. District heating and cooling. Energy storage.
7. Evaluation and optimization of energy systems. Energy, economy and sustainability.

5.4.Course planning and calendar

Communication between the student and the teacher will be managed via the virtual platform (ADD). Here the teacher can distribute course materials (notes, presentations, problems and solved cases, technical and economic information on equipment and thermal installations and advanced energy production systems, specialized software, etc.), make announcements and notifications to students, etc.

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5.5.Bibliography and recommended resources

- G Sarlos et al. *Systemes Energetiques*. Presses Polytechniques Romandes, 2003.
- RE Putman. *Industrial Energy Systems: Analysis, Optimization and Control*. ASME, 2004 (TERMO 30).
- M Kaltschmitt et al. *Renewable Energy - Technology, Economics and Environment*. Springer, 2007.
- JA Duffie, WA Beckman. *Solar Engineering of Thermal Processes*. Wiley, 2013 (TERMO 55).
- S Kalogirou. *Solar Energy Engineering - Processes and Systems*. Elsevier, 2009.
- TC Elliot et al. *Standard Handbook of Powerplant Engineering*. McGraw-Hill, 1998 (ELECTROT 182).
- N Petchers. *Combined heating, cooling and power handbook*. Fairmont Press, 2003 (TERMO 206).
- S Frederiksen, S Werner. *District Heating and Cooling*. Studentlitteratur, 2013.
- I Dincer, M Rosen. *Thermal energy storage - Systems and applications*. Wiley, 2002 (TERMO 187).
- JW Tester et al. *Sustainable Energy - Choosing among options*. MIT Press, 2005.