

66331 - Hydrogen and Fuel cells

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 324 - Master's in Renewable Energies and Energy Efficiency
ECTS	5.0
Course	1
Period	Half-yearly
Subject Type	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

This course includes oral presentations, practical sessions with exercises in the blackboard and practical sessions using dedicated software to solve longer problems and parametric studies. Also, after computer practical sessions students are welcomed to work in small groups to complete the tasks that have been commenced during the class and submit them to the professor at the date due.

5.2.Learning activities

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- 1) Lectures (40 hours): the professor explains the contents of the syllabus (see 5.3).
- 2) Computer lab sessions (10 hours, presential): there are 5 computer sessions where a more complex case is presented and solved by the use of dedicated software (EES). The concepts learned in lectures are completed and developed in these practical sessions. Additional work that must be done individually or by pairs (depending of the number of students) after the practical sessions and submitted in the date due for assessment.
- 3) Some shorts exercises must be done by the students as homework to have a feedback for both, students and professors, about the level of comprehension of the concepts from time to time.

5.3.Program

Part 1 Hydrogen

- 1.1 Properties of hydrogen
- 1.2 Hydrogen production processes: steam reforming and eletrolysis of water.
- 1.3 Hydrogen production with renewable energies.
- 1.4 Storage, transportation and distribution of hydrogen

Fuel Cells

- 2.1 Basic structure of a fuel cell
- 2.2 Energy and mass balances. Polarization curve of a fuel cell.
- 2.3 Auxiliary systems in a fuel cell stack
- 2.4 Low temperature fuel cells: PEMFC and DMFC
- 2.5 High temperature fuel cells: MCFC and SOFC
- 2.6 Other FC: AFC and PAFC
- 2.7 Fuel cell systems.

5.4.Planning and scheduling

Lectures and practical sessions timetable will be published in the web page of each center (http://eina.unizar.es/intraneteina/index.php?r=calendarioExtN/index_oficial or [http://eupt.unizar.es/.](http://eupt.unizar.es/))

5.5. Bibliography and recommended resources