Grado en Ingeniería de Materiales

Department (School) / Departamento (Escuela)
Departamento de Ciencia de Materiales (ETSI Caminos Canales y Puertos)

Asignatura / Subject
Materials Recycling

ECTS	Type	Curso / Semestre	Idioma	Sylabus code	Subject Code
6	Compulsory	3 / 6	EN	04MI	45000128

Lecturers (Name)	Contact email	Office hours (Tutorials)
Jesús Ruiz Hervías	jesus.ruiz@upm.es	Tuesday and Wednesday 10:00-12:00
Mónica Carboneras Chamorro	monica.carboneras@upm.es	Tuesday and Wednesday 10:00-12:00
De-Yi Wang	IMDEA Materials Institute (Invited lecturer)	
Rob Wallach	University of Cambridge (invited lecturer)	

El profesor que aparece en primer lugar es el coordinador de la asignatura

Criterio de evaluación

Continuous assessment
Passmark: 50/120 points
There will be two mid-term partial exams and a term project for all students:
- Mid-term exams: maximum 30 points each (total of 60 points for the two of them).
  In order to pass the course in the continuous assessment mode, the students should get at least 12/30 points in each of the mid-term exams.
- Term project: maximum 40 points.
- Attitude and behaviour: maximum 20 points.
Ordinary Exam (June)
Passmark: 50/100 points.
For those students who were not evaluated through continuous assessment. The exam covers the whole subject (lectures and seminars).
Extraordinary Exam (July)
Passmark: 50/100 points.
For those students who did not pass the continuous assessment or the ordinary exam.

Justification and Objectives

At the end of this course, the student should be able to:
- Explain the main concepts of the recycling of materials and sustainability disciplines, and discuss the importance of a rational use of natural resources.
- Appropriately use life-cycle analysis to estimate the costs and implications of recycling activities in our lives.
- Apply these skills and knowledge to develop a spin-off company based on recycling of materials and sustainability.
In addition to that, the student should improve his transferable skills including oral and written communication, team work and decision making, time and project management, and work ethics.

Prerequisites
There is no pre-requirement for this course

Previous knowledge of the student
Chemistry and Physics (basic)

Generic competencies
CG1: English communication skills
CG2: Team work capabilities

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CG3: Spoken and written communication
CG4: Usage of CIT
CG11: Responsibility and professional ethics

Specific competencies
CE1: Identify the main waste separation techniques.
CE2: Identify the main recycling processes for metals.
CE3: Identify the main recycling processes for polymers
CE4: Develop a business idea out of recycling and sustainability concepts

Bibliography
- Ramachandra Rao, S. "Resource Recovery and Recycling from Metallurgical Wastes". Elsevier, 2006
- Lund, H.F. "Recycling Handbook, 2nd Edition". McGraw-Hill, 2000.
- Class presentations (uploaded to Moodle platform)

Subject contents and time distribution

The course contents are shown in the following table. There will be lectures and seminars on the main topics. In addition, invited speakers will give conferences on several topics. The students will have to present a team work at the end of the term that will be a very important part of the course.

Item	Contents	Code
1	Basics of recycling	LM
2	Waste separation techniques: (I) Physical processes; (II) Physico-chemical processes	LM
3	Visit to a waste management plant	VI
4	Recycling of polymers: (I) General overview; (II) PET; (III) Polyolefins (LDPE, HDPE, PP); (IV) PVC; (V) PS; (VI) Thermosetting polymers and their composites	LM
5	First mid-term exam	EV
6	Recycling of metals: (I) Hydrometallurgical processes; (II) Pyrometallurgical processes; (III) Recycling of ferrous metals; (IV) Recycling of non-ferrous metals	LM
7	Seminar on materials, energy and sustainability	LM
8	Presentation of term projects	TG
9	Second mid-term exam	EV

LM: Lesson at room, TG: Group Work, VI: Visits, EV: Exams