

**COURSE GUIDE: 2016-17**

<b>COURSE DETAILS</b>			
Name :	Wastewater Treatment by Solar Energy (UAL)		
Code :	70801202	Plan :	Master in Chemical Engineering
Academic year :	2016-2017	Level :	Official University Master
Course :	1	Type :	Optional
Semester :	Second semester		
<b>TIME DISTRIBUTION IN ACCORDANCE WITH REGULATION</b>			
ECTS :	3	In-class hours:	22,5
		Not in-class hours:	52,5
		Total time (in hours):	75
<b>USE OF VIRTUAL PLATFORM:</b>		Teaching support	

<b>LECTURER DETAILS</b>			
Name	Casas López, José Luis		
Department	Engineering Department		
Building	Edificio Científico Técnico II - A		
Office	1.40		
Phone	+34 950 015832	E-mail	<a href="mailto:jlcasas@ual.es">jlcasas@ual.es</a>
Personal webpage			
Name	Sánchez Pérez, José Antonio		
Department	Engineering Department		
Building	Edificio Científico Técnico II - A		
Office	1.38		
Phone	+34 950 015314	E-mail	<a href="mailto:jsanchez@ual.es">jsanchez@ual.es</a>
Personal webpage			

Puede verificar la autenticidad, validez e integridad de este documento en la dirección:  
<https://verificarfirma.ual.es/verificarfirma/code/QovJH7f/pGhueWZ6mSpZYA==>

<b>Firmado Por</b>	<b>Universidad De Almeria</b>	<b>Fecha</b>	<b>19/01/2017</b>
<b>ID. FIRMA</b>	<b>blade39adm.ual.es</b>	<b>PÁGINA</b>	<b>1/5</b>
			
QovJH7f/pGhueWZ6mSpZYA==			

<b>ACTIVITIES ORGANIZATION</b>	
<i>Planned activities for learning and workload distribution per activity (in hours)</i>	
I. STUDENT'S ACTIVITIES (In-class / Online)	• Seminars [Example] 0,0
	• Teaching group [Example] 13,5
	• Work group / small group [Example] 9,0
	<i>Total In-class/Online time :</i> 22,5
II. STUDENT'S AUTONOMOUS ACTIVITIES (not in-class)	• 52,5
	<i>Total not in-class time :</i> 52,5
<b>TOTAL WORKING HOURS</b>	<b>75</b>

<b>ELEMENTS OF INTEREST FOR COURSE LEARNING</b>
<b>Justification of contents</b>
The information and tasks of the subject will provide the student with the necessary knowledge and skills to design and run an AOP to treat wastewater, alone or combined with a biological process. The design should begin with the characterization of the water to treat. The choice of the treatment type will be determined by the aims of the process. The student will acquire the fundamentals of the AOPs mainly the solar driven photocatalytic process.
<b>Other courses related</b>
Advanced Analysis and Design of Chemical Reactors Simulation, Optimization and Control of Chemical Processes Process and Chemicals Products Design R&D in Chemical Engineering
<b>Minimum knowledge required to deal with the Course</b>
Fundamentals of Transfer Operations, Chemical Reactors and Industrial Chemistry

<b>COMPETENCIES</b>
<b>General competencies</b>
<i>General objectives of the University of Almería</i>
CG2 – Conceive, plan, calculate and design processes, equipment, industrial facilities and services in the field of chemical engineering and related industrial sectors, in terms of quality, safety, process economy, rational and efficient use of natural resources and environmental protection.
CG4 – To carry out the appropriate research, start the design and to direct the development of engineering solutions in unknown or new areas, connecting, creativity, originality, innovation and technology transfer.
CB8. That the students are able to integrate knowledge and deal with the complexity of formulating opinions from limited or incomplete information, including reflections on social responsibilities and ethics linked to the application of their knowledge and opinions.
<i>Other general objectives</i>

Puede verificar la autenticidad, validez e integridad de este documento en la dirección:  
<https://verificarfirma.ual.es/verificarfirma/code/QovJH7f/pGhueWZ6mSpZYA==>

<b>Firmado Por</b>	<b>Universidad De Almería</b>	<b>Fecha</b>	<b>19/01/2017</b>
<b>ID. FIRMA</b>	blade39adm.ual.es	<b>PÁGINA</b>	<b>2/5</b>
			
QovJH7f/pGhueWZ6mSpZYA==			

CT2 – To use IT tools and software for the treatment and dissemination of the results produced by scientific and technology research.

CT5 – Ethical commitment within the sustainable development framework

**Specific competencies developed**

CE2.- To design products, processes, systems, and services for the chemical industry, as well as the optimization of others already developed, built from the technology basis of the different areas of chemical engineering including processes and transport phenomena, separation operations and chemical, nuclear, electrochemical and biochemical reaction engineering.

CE6 – To design, built and implement methods, processes and facilities for the comprehensive management of supplies and solid, liquid and gaseous waste, in industry, being able to assess their risks and impacts.

**LEARNING OBJECTIVES/OUTCOMES**

The subject contents and activities will provide the student with the knowledge and skills needed to carry out the design and operation of an advanced oxidation process (AOPs) for wastewater treatment, alone or combined with a biological process. This design should begin with the characterization of the water to be treated. The choice of treatment type will be determined by the aims of the process. The students will learn the fundamentals of AOPs mainly photocatalytics.

**CONTENTS**

<b>Module</b>	Methodology to carry out the design of a combined system for the treatment of wastewater
---------------	--

<b>Content</b>	Wastewater characterization
----------------	-----------------------------

**Learning system and methodology**

<i>System</i>	<i>Learning procedures and activities</i>	<i>Observations</i>	<i>Hours In-class/ Online</i>
Teaching group	Lecture, debate		2,0

**Description of autonomous workload**

<b>Content</b>	Choice of the correct treatment (only AOP, only BT, AOP-BT, BT-AOP)
----------------	---

**Learning system and methodology**

<i>System</i>	<i>Learning procedures and activities</i>	<i>Observations</i>	<i>Hours In-class/ Online</i>
Teaching group	Lecture, debate		2,0
Work group	Problem-based learning		1,0
Work group	Information search		1,0

**Description of autonomous workload**

Puede verificar la autenticidad, validez e integridad de este documento en la dirección:  
<https://verificarfirma.ual.es/verificarfirma/code/QovJH7f/pGhueWZ6mSpZYA==>

<b>Firmado Por</b>	<b>Universidad De Almeria</b>	<b>Fecha</b>	<b>19/01/2017</b>
<b>ID. FIRMA</b>	blade39adm.ual.es	<b>PÁGINA</b>	<b>3/5</b>



QovJH7f/pGhueWZ6mSpZYA==

<b>Module</b>	Kinetics studies of the individual processes and the combined processes		
<b>Content</b>	Modelling		
<b>Learning system and methodology</b>			
<i>System</i>	<i>Learning procedures and activities</i>	<i>Observations</i>	<i>Hours In-class/ Online</i>
Teaching group	Lecture, debate		2,0
Work group	Problem-based learning		2,0
<b>Description of autonomous workload</b>			
<b>Content</b>	Economic viability study of the process		
<b>Learning system and methodology</b>			
<i>System</i>	<i>Learning procedures and activities</i>	<i>Observations</i>	<i>Hours In-class/ Online</i>
Teaching group	Lecture, debate		2,0
Work group	Problem-based learning		1,0
Work group	Information search		1,0
<b>Description of autonomous workload</b>			
<b>Content</b>	Facility design		
<b>Learning system and methodology</b>			
<i>System</i>	<i>Learning procedures and activities</i>	<i>Observations</i>	<i>Hours In-class/ Online</i>
Teaching group	Lecture, debate		3,5
Teaching group	Evaluation session		2,0
Work group	Problem-based learning		2,0
Work group	Making reports		1,0
<b>Description of autonomous workload</b>			

## EVALUATION SYSTEM

### Assessment criteria

To write reports and to show calculations in a clear, accurate and specific fashion. To write answer to the questions of the written exams and their calculations in a clear, accurate and specific fashion. To accurately identify the fundamentals and superfluous elements of either their own written report / oral presentation, or that of another. To do the assigned tasks in an appropriate and timely manner. To apply the theoretical knowledge of the subject in order to find a solution to the task at hand. To find the correct solution to the task at hand in a timely manner. Get to know and apply the treatment operations design methods. Get to know and apply the operational design methods based on biological treatment.

Skills assessment:

Puede verificar la autenticidad, validez e integridad de este documento en la dirección:  
<https://verificarfirma.ual.es/verificarfirma/code/QovJH7f/pGhueWZ6mSpZYA==>

Firmado Por

Universidad De Almería

Fecha

19/01/2017

ID. FIRMA

blade39adm.ual.es

QovJH7f/pGhueWZ6mSpZYA==

PÁGINA

4/5



QovJH7f/pGhueWZ6mSpZYA==

- Presentation of work and activities (70%) Skills evaluated CG4, CB8, CT2, CT5, CE2 and CE6.
- Written tests (30%) Skills evaluated CG2, CE2 and CE6.

#### Marking system

	Activity	(Number of hours)	Percentage
I. STUDENT'S ACTIVITIES (In-class/Online)	• Teaching group	13,5	18%
	• Work group/ small group	9	12%
II. STUDENT'S AUTONOMOUS ACTIVITIES (Autonomous work)	• Individual work [example]	52,5	70%

#### Assessment instruments

- Tests, exercises, problems.
- Final assessment reports, papers, projects, etc.
- Final tests (written or oral).

#### Monitoring mechanisms

- Tutorial attendance
- Seminar attendance and participation
- Sign up and access virtual classroom
- Submit class tasks

### BIBLIOGRAPHY

#### Recommended bibliography

- Combination of Advanced Oxidation Processes and biological treatments for wastewater decontamination-A review ( Oller, I., Malato, S., Sánchez-Pérez, J.A.)

#### Bibliography existing in the library of the University of Almeria

[http://almirez.ua.es/search/e?SEARCH=DEPURACION DE AGUAS MEDIANTE ENERGIA SOLAR \(UAL\)](http://almirez.ua.es/search/e?SEARCH=DEPURACION DE AGUAS MEDIANTE ENERGIA SOLAR (UAL))

#### WEB ADRESSES

<http://www.ciesol.es/>

Puede verificar la autenticidad, validez e integridad de este documento en la dirección:  
<https://verificarfirma.ual.es/verificarfirma/code/QovJH7f/pGhueWZ6mSpZYA==>

Firmado Por	Universidad De Almeria	Fecha	19/01/2017
ID. FIRMA	blade39adm.ual.es	PÁGINA	5/5
			
QovJH7f/pGhueWZ6mSpZYA==			