Universitat Autònoma de Barcelona

2019/2020

Solid Waste Treatment and Renewable Energy Sources

Code: 102429
ECTS Credits: 5

Degree	Type	Year	Semester
2500897 Chemical Engineering	OT	4	0

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Teachers

Vanessa Abad Cuñado

Prerequisites

It is recommended that the course Enginyeria del Medi Ambient has been passed.

Objectives and Contextualisation

- General knowledge of urban and industrial solid waste, and its associated problems.
- Understand waste treatment options hierarchy.
- Ability to interpret the properties associated with solid waste, especially to its biodegradability and ways of measuring it.
- To interpret the scientific basis of the biological processes of organic waste treatments: anaerobic digestion and composting.
- Assessment of the most important environmental impacts of a controlled landfill.
- Understand industrial waste management model.
- Main features of the different waste thermal treatment processes.
- Renewable energy sources that are obtained from the waste.
- Main characteristics of solar and wind energy

Competences

- Analyse, evaluate, design and operate the systems or processes, equipment and installations used in chemical engineering in accordance with certain requirements, standards and specifications following the principles of sustainable development.
- Demonstrate knowledge of the different reaction, separation and processing operations for materials, and transport and circulation of fluids involved in the industrial processes of chemical engineering.
- Develop personal work habits.
- Develop thinking habits.

- Objectively compare and select different technical options for chemical processes.
- Observe ethics and professionalism.
- Show an understanding of the role of chemical engineering in the prevention and resolution of environmental and energy problems, in accordance with the principles of sustainable development.
- Understand and apply the basic principles on which chemical engineering is founded, and more precisely: balances of matter, energy and thermodynamic momentum, phase equilibrium and kinetic chemical equilibrium of the physical processes of matter, energy and momentum transfer, and kinetics of chemical reactions

Learning Outcomes

1. Apply matter and energy balance to typical continuous and discontinuous environmental engineering systems.
2. Apply the basics of chemical engineering to the treatment of urban and industrial solid waste and the obtainment of sources of renewable energy.
3. Apply unitary operations to environmental processes.
4. Describe and explain in depth the technologies, tools and techniques applied to the treatment of industrial and urban solid waste and the production of sources of renewable energy
5. Design and calculate engineering solutions to environmental problems.
6. Develop critical thinking and reasoning
7. Objectively distinguish different alternatives in solid and industrial waste treatment plants and in the processes of obtaining renewable energies
8. Perform characteristic separation operations in waste treatment.
9. Respect diversity in ideas, people and situations.
10. Work in complex or uncertain surroundings and with limited resources.
11. Work with common equipment used in the treatment of environmental problems.

Content

Topic 1. Introduction.

Topic 2. Municipal wastes.

Topic 3: Organic Waste Treatment: Composting

Topic 4: Organic waste treatment: Methanization.

Topic 5. Landfills.

Topic 6. Industrial Wastes.

Topic 7. Pre-treatment of Industrial Wastes.

Unit 8. Thermal treatments of Industrial Wastes.

Topic 9. Waste as a source of energy.

Topic 10. Solar energy and wind energy.

Methodology

1. Theory classes.

2. Problem classes, case studies, seminars, visits to companies.

The classes of problems will be carried out in a coordinated manner with the theory classes.

Case Study: Two studies will be carried out and delivered on Municipal Waste and Industrial Waste. The teacher will indicate the results to be presented and achieved every week.

T1 Proposal, analysis and selection of collection system of urban wastes produced in a municipality and a region. Pre-design of the necessary facilities.

Throughout the semester, the study of the waste management of a municipality and a county will be studied. The first part will consist of an individual work on the waste streams generated in a municipality and its management. In a second stage, analysis will be carried out at the county level. This work will be the group work (4-5 students) that the students will present orally at the end of the semester. The formation of groups and work topics will be proposed and established by the teacher.

T2. Selection of a type of industrial waste. Description of the activity that generates it and proposal of management. This work will be done individually, or small groups.

Seminar: An experienced person will be invited to participate in any of the topics of the program to conduct a lecture.

Visits: It is proposed to make a visit to companies or facilities. The visit date will be communicated in advance.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Theory classes	30	1.2	2, 3, 4, 7, 8
Type: Supervised			
Problem classes, case studies, seminars, visits to companies.	16	0.64	1, 2, 6, 5, 11, 9, 10
Type: Autonomous			
Exam	4	0.16	1, 2, 3, 4, 6, 5, 7, 8, 11
Student work	63	2.52	1, 2, 3, 4, 6, 5, 7, 8, 11

Assessment

The subject consists of the following evaluation activities:

- Exams: Two partial exams will be carried out throughout the course, each of which will be 30% on the final mark. The examinations will consist of questions related to the subject explained in theoretical classes, and the work done in a group and the visits to companies that have been carried out until the date of the exam.

- Case study T1 (municipal and county). Individual and group work: 25% (10% evaluation follow-up work + 15% deliver documentation and presentation).

- Case study T2 (industrial). Individual work: 15% (7.5% evaluation follow-up work + 7.5% delivery documentation).

Observations:

In the partial examinations a minimum mark of 3 of each part is needed to make an average, otherwise it will have to be presented directly to the examination of recovery of the whole subject.

In order to be able to pass the subject through the continuous evaluation, a minimum grade of 5 will be required in the overall average of the subject. In the event of not exceeding this note, the student may submit to a re-take exam if the student has been presented to a set of activities that represent a minimum of two thirds of the total grade of the subject.

The re-take exam will include all the contents of the subject and will be 60% of the final mark, which will have to add T1 (25%) and T2 (15%). According to the Degree in Chemical Engineering Coordination, case studies (T1 and T2) can not be recovered if suspended.

Students have the right to the revision of the final grades of their evaluation activities. The date for reviewing the qualifications will be informed in a timely manner through the Moodle platform.

A distinction can be given to students who score 9.0 or higher in a subject. The number of distinctions awarded to students cannot be higher than 5% of the total number of students enrolled in a subject. If the total number of students is lower than 20 thenonly one distinction will be awarded.

The returning date of the corrected reports will be informed in a timely manner, so that students can to review the correction and improve the aspects that are necessary for the following reports.

Without prejudice to other disciplinary measures, and in accordance with current academic regulations, any irregularities committed by the student that could lead to a variation of the score of an evaluation act will be scored with a zero. Therefore, copying or allowing to copy a practice or any other evaluation activity will imply a zero (0) in the attitude note and, therefore, suspend the course.

Repeaters are obliged to pass the full course.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Exams	60%	4	0.16	1, 2, 3, 4, 5, 7, 8, 11
Group work	25%	4	0.16	1, 2, 4, 6, 7, 8, 9, 10
Individual work	15%	4	0.16	6, 7, 10

Bibliography

- *Gestión de residuos tóxicos. Tratamiento, eliminación y recuperación de suelos.* Michael D. Lagrega, Phillip L. Buckingham, Jeffrey C. Evans. Editorial Mc Graw-Hill. 1996.

-*Gestión integral de residuos sólidos.* George Tchobanoglous, Hilary Theisen, Samuel A. Vigil. Editorial Mc Graw-Hill. 1994.

- Agència de Residus de Catalunya, www.arc.cat

- The Practical Handbook of Compost Engineering. R. T. Haug. Editorial CRC Press. 1993.

- Agència Europea del Medi Ambient, https://www.eea.europa.eu/