

Degree programme	Type	Course
Environmental Sciences	OP	4

Contact lecturer

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Prerequisites

General knowledge of Chemistry.

Group languages

You can consult this information at the [end](#) of the document.

Objectives

1. To assimilate the most important changes that the world of chemistry is experiencing in recent years in order to minimize its environmental impacts and achieve more sustainable modern societies. Green Chemistry.
2. To take a tour of the most notable cases of replacement of non-renewable, toxic, and dangerous materials with more sustainable alternatives.
3. To recognize the role of chemistry in the development of renewable energies.
4. To mention some particular issues of improvement in chemical processes and materials that have a decisive impact on sustainability on the planet.

Learning outcomes

- CM37 (Present proposals for the prevention and mitigation of the impact on the physical environment of natural or anthropogenic action, including that based on green chemistry.) Present proposals for the prevention and mitigation of the impact on the physical environment of natural or anthropogenic action, including that based on green chemistry.
- CM39 (Transmit general scientific information associated with an environmental problem to a general audience appropriately.) Transmit general scientific information associated with an environmental problem to a general audience appropriately.
- KM47 (Recognise the way in which human activity has an impact on the function of physical vectors (water, soil, oceans, atmosphere) in the natural environment.) Recognise the way in which human activity has an impact on the function of physical vectors (water, soil, oceans, atmosphere) in the natural environment.
- SM46 (Characterise the main processes of natural environments (marine, soil, atmosphere), including aspects of physics, chemistry, geology, biology and their interaction.) Characterise the main processes of natural environments (marine, soil, atmosphere), including aspects of physics, chemistry, geology, biology and their interaction.

Contents

1. Basic Concepts on Sustainable Chemistry

- 1.1. Pollution Risk Assessment.
- 1.2. Green Chemistry.
- 1.3. Life Cycle Analysis of Chemical Processes.
- 1.4. Assessment of the Distribution of Pollutants in the Environment: Fugacity Model.

2. Replacement of Materials

- 2.1. New Materials from Biomass.
- 2.2. Sustainable Synthesis of Polymers.
- 2.3. Biodiesels.
- 2.4. Ionic Liquids.
- 2.5. Solvents with Deep Eutectic Point.
- 2.6. Water as a Solvent.
- 2.7. Replacement of CFCs.
- 2.8. Graphene.
- 2.9. Metal Organic Frameworks
- 2.10. Sustainable Metals and Alloys.

3. Energy Replacement

- 3.1. Chemistry and Renewable Energies: Solar Cells and Windmills.
- 3.2. Energy Storage in Batteries.
- 3.3. Hydrogen.
- 3.4. Fuel Cells.

4. Other Important Topics

- 4.1.CO2 Capture.
- 4.2.Ammonia Production.
- 4.3.Desalination.
- 4.4.Desulfurization.
- 4.5.Photocatalysis for Urban Atmosphere Cleaning, Hydrogen Production and CO2 Removal.
- 4.6.Enzymatic Degradation of Plastics.

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Resolution of numerical problems and mathematical modeling on the distribution of pollutants in the environment.	10	0.4	CM37, CM39, KM47
Student autonomous learning	56	2.24	CM37, CM39,

				KM47, SM46
Theoretical classes: Master classes on the concepts of the syllabus	38	1.52	CM37, CM39, KM47	
Collaborative learning	30	1.2	CM37, CM39, KM47, SM46	

Theoretical classes: Lectures on the concepts of the syllabus.

Problem classes: Resolution of numerical problems and mathematical modeling on the distribution of pollutants in the environment.

Note: 15 minutes of a class will be reserved, within the calendar established by the center/degree, for the completion by students of the surveys to evaluate the performance of the teaching staff and to evaluate the subject/module.

Annotation: within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continuous assessment activities

Title	Weight	Hours	ECTS	Learning outcomes
Homeworks	10%	10	0.4	CM37, CM39, KM47, SM46
Two written tests with theoretical and practical parts	90%	6	0.24	CM37, CM39, KM47

Continuous assessment:

1st Partial: 45% of the final grade

2nd Partial: 45% of the final grade

1st Assignment: 5% of the final grade

2nd Assignment: 5% of the final grade

Second Chance Exam: 90% of the grade. The remaining 10% will be the grade for the assignments. The Second Chance exam will be for each partial.

The midterm exams will consist of multiple-choice questions and questions requiring students to develop reasoning skills.

A minimum final grade of 5.0 is required to pass.

Failure to participate in any of the activities will result in a grade of zero.

If neither of the two written exams is taken, the final grade will be "Not Assessable."

To participate in the resit exams, students must have been previously assessed on a set of activities that

account for at least 60% of the total grade for the course (either one of the midterm exams and both individual assignments, or both midterm exams). If a student has not been assessed on at least 60% of the assessments, they will receive a grade of "Not Assessable."

The commission of any irregularity in an assessment act (academic fraud, plagiarism or improper use of AI, unless this use is expressly authorized in the teaching guide), which may lead to a significant variation in the grade, means that this act will be graded with a 0. In the event that the teaching guide provides that in order to pass the subject it is an essential requirement to have obtained a minimum grade in this assessment act or that several irregularities occur in the assessment acts of the same subject, the final grade for this subject is 0. Apart from this, a disciplinary process may be initiated against the student who incurs any of these irregularities.

Single assessment:

Students who have opted for the single assessment method must take a final test that will consist of a theory exam where they must answer a series of short questions and develop a couple of topics. When finished, they will submit the practice reports.

The student's grade will be the weighted average of the previous activities, where the theory exam will account for 80% of the grade, and each of the practice reports 10% (1st and 2nd papers).

If the final grade does not reach 5, the student has another opportunity to pass the subject through the remedial exam that will be held on the date set by the degree coordination. In this test, 70% of the grade corresponding to the theory can be recovered. The practice part is not recoverable.

Use of AI

Restricted use: For this subject, the use of Artificial Intelligence (AI) technologies is permitted exclusively in support tasks, such as bibliographic or information searches, text correction or translations,... The student must clearly identify which parts have been generated with this technology, specify the tools used and include a critical reflection on how these have influenced the process and the final result of the activity. The lack of transparency in the use of AI in this assessable activity will be considered a lack of academic honesty and may lead to a partial or total penalty in the grade of the activity, or greater sanctions in serious cases.

Bibliography

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5. Deep Eutectic Solvents: A Review of Fundamentals and Applications. Hansen et al., Chem. Rev. 2021, 121, 3, 1232-1285. DOI:10.1021/acs.chemrev.0c00385.
6. Water as Green Solvent: Methods of Solubilisation and Extraction of Natural Products-Past, Present and Future Solutions. Lajoie, L.; Fabiano-Tixier, A.-S.; Chemat, F., Pharmaceuticals 2022, 15, 1507. DOI:

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7. <https://www.epa.gov/ozone-layer-protection/ozone-depleting-substances>

<https://www.sciencedaily.com/releases/2012/02/120224110737.htm>

<https://cen.acs.org/environment/persistent-pollutants/CFC-replacements-source-persistent-organic/98/web/2020/>

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Software

No especial software is needed

Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this [link](#). To access the information, you will need to enter the course CODE

Type of teaching	Group	Language	Semester	Shift
(TE) Theory	1	Catalan	second semester	morning-mixed
(PAUL) Classroom practices	1	Catalan	second semester	morning-mixed