UAB Universitat Autònoma de Barcelona

Environmental Sustainability in Processes and Products

Code: 43328
ECTS Credits: 6

2025/2026

Degree	Type	Year
Biological and Environmental Engineering	OB	1

Contact

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

Students must have a solid foundation of the following subjects:

- Energy and material balances

- Knowledge of thermodynamics.

Objectives and Contextualisation

The main objective of the module is for students to have the knowledge and tools to know how to evaluate processes and products, to optimize resources (materials and energy) and also minimize environmental impacts. Methods, tools, and strategies to quantify environmental impacts will be studied from a life cycle perspective of products and processes. The principles of thermodynamics will also be applied as a tool to quantify the use of resources, as well as the efficiency in the transformation of raw materials into products. The concepts are explained and applied in a project that students develop in groups.

Learning Outcomes

1. CA15 (Competence) Summarise, organise and plan projects related to improvements to the environmental sustainability of products, processes and services.
2. KA10 (Knowledge) Identify the main elements of Industrial Ecology: systems theory, thermodynamics, material flow analysis, and resource and energy consumption.
3. KA11 (Knowledge) Describe the existing methodologies for the assessment of industrial and environmental risk as a consequence of accidents.
4. KA12 (Knowledge) Differentiate the calculation procedures and databases required to apply the risk assessment methodologies.
5. SA03 (Skill) Plan the different activities related to the resolution of tasks assigned as part of a work group, while appropriately managing time and resources.
6. SA09 (Skill) Use the most adequate IT instruments to complement knowledge in the field of biological engineering and environmental engineering.

7. SA16 (Skill) Interpret and develop life cycle analysis for products and processes.

Content

Block I. Introduction to Sustainability

Concepts of environmental sustainability, the circular economy, and industrial ecology

Block II. Tools for Systems Analysis

1. Systems Theory

2. Principles and Laws of Thermodynamics

3. Application of Principles: Material Flow Analysis and Exergy Analysis

Block III. Tools for Product Analysis

1. Life Cycle Assessment (LCA)

a. Definition of Objectives and Functional Units

b. Generation of Inventories and Data Sources

c. Environmental Impact Assessment Methods

d. Case Studies and Programs

2. Other Tools: EC Environmental Footprint, Carbon Footprint, among others

Block IV. Environmental Risk Analysis

Analysis of Environmental Risk Indicators

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Exercices	16	0.64	KA11, KA12, SA09, SA16, KA11
Theory lecture	22	0.88	CA15, KA10, KA11, KA12, SA03, SA09, SA16, CA15
Type: Supervised			
Supervised work in the classroom	15	0.6	KA11, KA12, SA09, SA16, KA11
Type: Autonomous			
Group work	64	2.56	CA15, KA11, KA12, SA03, SA09, CA15
Individual work	20	0.8	KA10, KA12, SA09, SA16, KA10

This course combines theory classes with practical classes in which the students apply in groups and also individually the different methodologies of the course. We focus on learning different sustainability analysis methods and the computer tools necessary to implement them. The classes combine:

- Content presentation
- Exercises in class
- Informatics practices with the Simapro and EpiSuite programs
- Debates and student presentations
- A group project that includes an oral presentation and a final report

Materials for the class and information about the course will be communicated in the Moodle platform.

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

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Group Project	40%	6	0.24	CA15, KA11, KA12, SA03, SA09, SA16
Individual Deliverables	60%	7	0.28	CA15, KA10, KA11, KA12, SA09, SA16

This subject follows continuous assessment. The final grade is calculated as detailed below. Please see the syllabus to update this information.

Group work 40% (includes oral presentation and final report)
Individual assignments 60% (includes three individual reports)

Group work. The case study for the group work is chosen from a list of available cases related to the circular economy and industrial sustainability. The due date for the assignments will be announced on the first day of class.

Retake. The subject will be retaken with an individual in-depth assignment. The maximum grade that can be obtained with this assignment is 5.

Review. For each assessment activity, a place, date and time of review will be indicated in which the student can review the activity with the professor. In this context, inquiries may be made about the grade of the activity, which will be evaluated by the professor responsible for the subject. If the student does not attend this review, this activity will not be reviewed later.

Honors (MH). Awarding an honors grade is the decision of the teaching staff responsible for the subject. UAB regulations indicate that MHs may only be awarded to students who have obtained a final grade equal to or greater than 9.00. Up to 5% of MHs may be awarded to the total number of students enrolled.

Non-assessable. A student will be considered non-assessable (NA) if they have not presented the project (oral or written) and have not submitted any deliverables.

Without prejudice to other disciplinary measures deemed appropriate, irregularities committed by the student that may lead to a variation in the grade of an assessment act will be graded with a zero. Therefore, copying, plagiarism, cheating, allowing copying, etc. in any of the assessment activities will imply failing it with a zero.

SINGLE ASSESSMENT

This subject does not offer a single assessment

Bibliography

Textbooks

1. Klöpffer, W., & Grahl, B. (Birgit). (2018). Life cycle assessment (LCA): a guide to best practice.
2. Matthews, H.S., Hendrickson, C.T., Matthews, D.H., 2014. Life Cycle Assessment: Quantitative Approaches for Decisions that Matter.
3. SRI (Stanford Research Institute). Chemical economics handbook. Menlo Park CA: SRI International, 1989. https://ihsmarkit.com/products/chemical-economics-handbooks.html
4. Riegel's Handbook of Industrial Chemistry, 2003. , Riegel's Handbook of Industrial Chemistry. Springer US. https://doi.org/10.1007/0-387-23816-6
5. John Wiley & Sons, Inc (Ed.), 2000. Kirk-Othmer Encyclopedia of Chemical Technology, Kirk-Othmer Encyclopedia of Chemical Technology. Wiley. https://doi.org/10.1002/0471238961
6. Dincer, I., Rosen, M.A., 2007. Exergy: : energy, environment, and sustainable development. Elsevier Ltd. https://doi.org/10.1016/B978-0-08-044529-8.X5001-0
7. Brunner, P.H., Rechberger, H., 2016. Handbook of material flow analysis : for environmental, resource, and waste engineers. https://doi.org/10.1201/9781315313450-4
8. Miller, R.E., Blair, P.D., 2009. Input-Output Analysis: Foundations and Extensions, 2nd ed. Cambridge University Press.
9. Allen & Shonnard. 2018. Green Engineering: Environmentally Conscious Design of Chemical Processes. 2nd Edition.

Articles

Other references will be shared during the course and will be included with the classroom materials.

Software

Ecoinvent https://www.ecoinvent.org/

SimaPro https://simapro.com/

DoSE-LCACB https://lauratalens.eu.pythonanywhere.com

GaBi http://www.gabi-software.com/spain/index/

OpenLCA http://www.openlca.org/

STAN http://www.stan2web.net/

EPISUITE https://www.epa.gov/tsca-screening-tools/epi-suitetm-estimation-program-interface

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(TEm) Theory (master)	1	Spanish	second semester	morning-mixed