UAB
Universitat Autònoma de Barcelona

Environmental Sustainability in Processes and Products

Code: 43328
ECTS Credits: 6

2024/2025

Degree	Type	Year
4314579 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.
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7. SA09 (Skill) Use the most adequate IT instruments to complement knowledge in the field of biological engineering and environmental engineering.
8. SA09 (Skill) Use the most adequate IT instruments to complement knowledge in the field of biological engineering and environmental engineering.
9. SA16 (Skill) Interpret and develop life cycle analysis for products and processes.

Content

Bloc I. Introduction to industrial ecology
1. Principles and laws of thermodynamics
2. Application of principles: analysis of material flows

Block II. Life Cycle Analysis
1. Definition of objects and functional units in LCA
2. Generation of inventories and data sources
3. Environmental impact assessment methods
4. Case studies

Block III. Environmental risk analysis
1. Analysis and 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	KA10, KA11, SA09, SA16, KA10
Type: Supervised			
Supervised work in the classroom	15	0.6	KA10, KA11, KA12, SA09, SA16, KA10
Type: Autonomous			
Group work	64	2.56	CA15, SA03, SA09, SA16, CA15
Individual work	20	0.8	CA15, KA10, KA12, SA09, SA16, CA15

This is a hands-on training course. It uses the analysis of a production system as case study for group and individual work. We learn different methods for sustainability assessment and the software needed to develop it.

We combine:

- Lectures
- Class exercises
- Computer work
- Student presentations and debates
- A group project that includes the writing of a final report

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	KA10, KA11, KA12, SA16

This course follows a continuous evaluation. The table shows an orientation of how grades are calculated. Please check syllabus for updated percentages

- Group project 40%
- Individual Deliverable 60%

Group work. The case study will be selected from a list of cases related to the energy transition.

Submission deadlines will be presented during th first day of the course.

Retakes. If the course is failed there will be the possibilty of presenting an individual work with an in depth critical analysis of a part of the course contents. The maximum grade granted in this case will be a 5.00.

Grade Reviews. For each evaluation activity, a place, date and time of review will be indicated in which the student can review the activity with the teaching staff. In this context, claims may be made regarding the grade of the activity, which will be evaluated by the faculty responsible for the subject. If the student does not appear in this review, this activity will not bereviewed later.

Honor plates (MH). Granting an honors qualification is the decision of the teaching staff responsible for the subject. The regulations of the UAB indicate that MH may only begrantedto students who have obtained a final grade of 9.00 or higher. Up to 5% of MH of the total number of students enrolled can be granted a MH.

A student will be considered non-evaluable (NA) if he has not submitted the project (oral or written) and has not done any of the theoretical and practical tests.

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

Unique Assessment

This subjectdoes not effert 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

A list of articles will be provided with the syllabus

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

Language list

Name	Group	Language	Semester	Turn
(TEm) Theory (master)	1	English	second semester	afternoon