

Industrial Ecology

Code: 42405
ECTS Credits: 9

2025/2026

Degree	Type	Year
Interdisciplinary Studies in Environmental, Economic and Social Sustainability	OT	0

Contact

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Teachers

Anna Petit Boix

Teaching groups languages

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

Prerequisites

NO REQUIREMENTS

Objectives and Contextualisation

This course is an introduction to the field of Industrial Ecology (IE) as a multidisciplinary effort to evaluate anthropogenic systems, minimizing their negative effect on our planet. The students are taught the methods, tools, and strategies within IE, aiming to recreate our industrial system in such a way that it can be sustainable and in harmony with the rest of the natural ecosystem. To achieve this general objective, we will learn about:

- the concepts of IE, its framework as a multidisciplinary area of research based on systems theory;
- Material Flow Analysis (MFA), which can be applied to different systems, such as a product, process, or region.
- the concepts of urban metabolism, carbon footprint, including differences in scope, results, and policy implications.
- process-based approach, MFA-LCA (or Material Flow Analysis coupled with Life Cycle Assessment) and EIO-LCA (or Economic Input-Output coupled with Life Cycle Assessment); the fundamentals of these approaches will be applied to various analyses (e.g., GHG, pollution, water, land, toxics, materials use, etc.)
- the concept of Life Cycle Assessment (LCA), its applications and the global framework for its use.
- the main steps of LCA (i.e., goal and scope definition, inventory analysis, impact assessment and interpretation) and their application to different real-life cases, such as products or services.

- the use of LCA software (SimaPro) and its basic functionalities to calculate the environmental impacts of a system.
- the concept of exergy in the context of thermodynamics in systems theory and its applications

Competences

- Analyse, summarise, organise and plan projects related to the environmental improvement of product, processes and services.
- Apply specific methodologies, techniques and resources to conduct research and produce innovative results in the area of Environmental Studies.
- Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
- Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
- Work in an international, multidisciplinary context.

Learning Outcomes

1. Analyse research results to obtain new products or processes, assessing their industrial and commercial viability with a view to transferring them to society.
2. Apply knowledge of the different tools of industrial ecology to systems independently of scale.
3. Apply specific methodologies, techniques and resources to conduct research and produce innovative results in the area of Environmental Studies.
4. Apply the concepts learnt in class, make assessments and take decisions based on results.
5. Interpret and develop life-cycle analyses for products and processes.
6. Know the main elements of industrial ecology: systems theory, thermodynamics, material flow analysis and resource consumption.
7. Know the tools of eco-innovation that are applicable to urban environments.
8. Know urban systems and their indicators in order to evaluate them.
9. Work in an international, multidisciplinary context.

Content

Content

The contents of the course can be summarized as follows:

- Industrial Ecology and Technological change.
- Introduction to material flow analysis.
- Introduction to urban metabolism, carbon footprint and case studies.
- Introduction to LCA
- Introduction to LCA software, case study project.
- Introduction to process-based approach, MFA-LCA (or Material Flow Analysis coupled with Life-Cycle Assessment), and EIO-LCA (or Economic Input-Output coupled with Life-Cycle Assessment).
- Introduction to thermodynamics

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
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Type: Directed				
LCA computer lab	12	0.48	1, 2, 3, 6, 8, 7, 5, 4, 9	
Theory Classes	36.5	1.46	1, 2, 3, 6, 8, 7, 5, 4, 9	
Type: Supervised				
Work on LCA project using guidelines	60	2.4	1, 2, 3, 6, 8, 7, 5, 4, 9	
Type: Autonomous				
Input-Output tables and LCA	16	0.64		
LCA project	78	3.12	1, 2, 3, 6, 8, 7, 5, 4, 9	
Readings, study, work in groups and preparation for presentations	17	0.68		

The key concepts of this class will be transferred through theory classes (36.5 hours), hands-on exercises in lab classes (12 hours), and a hefty load of autonomous and group work (111 hours).

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.

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Assessment

Continuous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Final Exam	50%	2	0.08	1, 2, 3, 8, 7, 5, 4, 9
input output exercise	10%	1.5	0.06	2, 3, 5, 4
LCA exercise	10%	0	0	2, 6, 5, 4
LCA project presentation	30%	2	0.08	2, 6, 5, 4

The student will only be able to take the make-up exam if he/she has:

- delivered all the class assignments through the moodle platform.
- has taken the final exam.
- has participated in group work during the course
- has worked on the LCA project and has participated in the presentation of the LCA project.

If a student meets all these requirements and passes the make-up exam, his/her final grade for the course will not be higher than a 6.

In this subject, the use of Artificial Intelligence (AI) technologies is allowed as an integral part of the development of the work, provided that the final result reflects a significant contribution of the student in the

analysis and personal reflection. 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 will be considered a lack of academic honesty and may lead to a penalty in the grade of the activity, or greater sanctions in serious cases.

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Software

LCA software (Open LCA, simapro, Gabi)

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
(PAULm) Classroom practices (master)	1	English	first semester	afternoon
(TEM) Theory (master)	1	English	first semester	afternoon