Universitat Autònoma de Barcelona

2021/2022

Industrial Ecology

Code: 42405
ECTS Credits: 9

Degree	Type	Year	Semester
4313784 Interdisciplinary Studies in Environmental, Economic and Social Sustainability	OT	0	1

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

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Use of Languages

Principal working language: english (eng)

Teachers

Cristina Madrid López

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, aimed 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:

- Understand the concepts of IE, its framework as a multidisciplinary area of research based on system theory; resources: environmental goods and services, externalities.
- Understand Material Flow Analysis (MFA), and be able to apply this tool to different systems, such as a product, process, or region.
- Understand the concepts of urban metabolism, carbon footprint, including differences in scope, results, and policy implications.
- Understand both 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); apply the fundamentals of these approaches to be used for various analyses (e.g., GHG, pollution, water, land, toxics, materials use, etc.)

- Understand the concept of LCA, its applications and the global framework for its use.
- Understand the main steps of LCA (i.e., goal and scope definition, inventory analysis, impact assessment and interpretation) and be able to apply them to different real-life cases, such as products or services.
- Learn how to evaluate and interpret the results, assumptions and uncertainties in case studies from a critical point of view.
- Learn how to use the Open LCA software and its basic functionalities and be able tocalculate the environmental impacts of a system by means of it.

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

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 process-based approach, MFA-LCA (or Material Flow Analysis coupled with Life-Cycle Assessment), using actual energy use data to model systems; and EIO-LCA (or Economic Input-Output coupled with Life-Cycle Assessment), which adopts IO tables to study the inter-dependencies of economies. The fundamentals of these approaches will be used for various analyses (e.g., GHG, pollution, water, land, toxics, materials use, etc.
- Introduction to LCA
- Interpretation and uncertainty
- introduction to LCA software, case study project.

Methodology

The key concepts of this class will be transferred through theory classes (33 hours), hands-on exercises in lab classes (21 hours), and a hefty load of autonomous and group work (120 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.

Activities

Title	Hours	ECTS	Learning Outcomes

Type: Directed		
Industrial Ecology- Theory Classes	12	0.48
LCA-IO Table - Theory Classes	9	0.36
MFA - Theory Classes	12	0.48
Type: Supervised		
LCA Computer Lab	21	0.84
Type: Autonomous		
Input-Output tables and LCA	16	0.64
LCA project	38	1.52
LCA project- Readings, study, work in groups and preparation for presentations	35	1.4
LCA projects - Readings, study, work in groups and preparation for presentations	30	1.2
MFA project- Readings, study, work in groups and preparation for presentations	37	1.48

Assessment

The daily quiz will be given at the beginning of class, and will serve to count assistance and timely arrival to the class. They will only last 10 minutes. There will also be peer evaluation that will be taken into account for the presentations.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Individual daily quiz	15%	1.5	0.06	2, 3, 6, 4, 9
Final Exam	50%	11.5	0.46	1, 2, 3, 8, 7, 5, 4, 9
LCA project presentation	20%	2	0.08	2, 6, 5, 4
input output exercise	15%	0	0	2, 3

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Software

LCA software (Open LCA, simapro, Gabi)