



Course guide

250MEA000 - 250MEA000 - Life Cycle Analysis and Sustainability

Last modified: 20/06/2024

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.

Degree: MASTER'S DEGREE IN ENVIRONMENTAL ENGINEERING (Syllabus 2024). (Compulsory subject).

Academic year: 2024 **ECTS Credits:** 5.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: MARIANNA GARFI

Others: Garfi, Marianna
Ziegler Rodriguez, Kurt Eduardo

TEACHING METHODOLOGY

The course consists of 3 hours per week of lectures.

Lectures are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples, solves exercises and develops practical sessions using software.

The practical sessions are devoted to solve practical problems with greater interaction with the students and using specific software. The objective of these practical exercises is to consolidate the general and specific learning objectives.

Specific software will also be used.

Teaching material is provided using the virtual campus ATENEA: content, program of learning and assessment activities conducted and literature.

The teaching material will be in English, Catalan and/or Spanish.

Although most of the sessions will be given in the language indicated, sessions supported by other occasional guest experts may be held in other languages.

LEARNING OBJECTIVES OF THE SUBJECT

This subject presents the most important aspects related to Life Cycle Assessment (LCA) tools for the analysis of environmental, social and economic impacts and the sustainability analysis of products, activities, technologies or processes related to the environmental engineering.

Students will be introduced to concepts related to sustainable development, Sustainable Development Goals, Life Cycle Thinking and Sustainability Assessment: environmental and social LCA, Life Cycle Costing, carbon footprint and water footprint. Ecodesign and Ecolabel.

The learning objectives are:

- To describe the fundamentals of LCA, including its four main phases and LCA report content
- To carry out a LCA project by:
 - o Compiling an inventory of relevant energy and material inputs and environmental releases
 - o Evaluating the potential impacts associated with identified inputs and releases
 - o Interpreting the results
 - o Writing the LCA report according to ISO Standards
- To Identify the potential and limitations of LCA in practice
- To apply LCA and sustainability assessment results to support decision making

STUDY LOAD

| Type | Hours | Percentage |
|--------------------|-------|------------|
| Hours medium group | 9,8 | 7.83 |
| Hours small group | 9,8 | 7.83 |
| Hours large group | 25,5 | 20.38 |
| Self study | 80,0 | 63.95 |

Total learning time: 125.1 h

CONTENTS

Introduction to the subject

Description:

Approach, objectives, bibliography, coursework, evaluation methodology.

Specific objectives:

To know the contents, methodology and organization of the subject.

Full-or-part-time: 2h 35m

Theory classes: 1h

Self study : 1h 35m



Environment and sustainability

Description:

Sustainable development, SDGs and sustainability: background and historical development.

Specific objectives:

To know the fundamentals on environment, sustainable development, SDG and sustainability.

Full-or-part-time: 2h 35m

Theory classes: 1h

Self study : 1h 35m

Life Cycle Thinking and Life Cycle Assessment tools

Description:

Life Cycle Thinking and Sustainability Assessment: environmental and social LCA, Life Cycle Costing, carbon footprint and water footprint. Ecodesign and Ecolabel. Fundamentals.

Specific objectives:

To know the fundamentals of Life Cycle Thinking tools and Sustainability Assessment.

Full-or-part-time: 8h 10m

Theory classes: 3h

Self study : 5h 10m

Environmental Life Cycle Assessment

Description:

- Introduction and overview
- Goal and scope: Goal definition, Scope definition, Functional Unit, System boundaries, Allocation, Data quality requirement, Comparison of different systems
- Life Cycle Inventory: Inventory analysis, Data collection and processing
- Impact assessment: Classification, Characterization, Normalization, Weighting, Methods
- Interpretation
- Sensitivity analysis
- ISO Standards
- LCA Report

Specific objectives:

To describe the fundamentals of LCA, including its four main phases and LCA report content.

Related activities:

Coursework (LCA project: oral presentations and report).

Full-or-part-time: 49h

Theory classes: 2h 30m

Practical classes: 15h

Self study : 31h 30m

Software SimaPro

Description:

- Overview and software interface description
- Database and Methods (Libraries)
- Create Processes
- Create assembly
- Waste scenario
- Impact analysis and results (table and charts)
- Allocation
- Sensitivity analysis and parameters

Specific objectives:

- To carry out a LCA project by:
 - o Compiling an inventory of relevant energy and material inputs and environmental releases
 - o Evaluating the potential impacts associated with identified inputs and releases
 - o Interpreting the results
 - o Writing the LCA report according to ISO Standards
- To Identify the potential and limitations of LCA in practice
- To apply LCA results to support decision making

Related activities:

- Coursework (LCA project: report and oral presentations).

Full-or-part-time: 49h

Theory classes: 2h 30m

Practical classes: 15h

Self study : 31h 30m

Sustainability assessment (multi-criteria analysis)

Description:

Fundamentals (criteria definition, weights, alternatives evaluation, decision making) and case studies.

Specific objectives:

To know the fundamentals of Sustainability assessment and its role in the decision making process.

Full-or-part-time: 5h 30m

Theory classes: 2h

Self study : 3h 30m

Evaluation

Description:

Evaluation of knowledge, skills and objectives achievement. Self-evaluation and Peer-evaluation.

Related activities:

First exam (oral presentation), Second exam (test), Coursework (report and oral presentation).

Full-or-part-time: 8h 10m

Theory classes: 3h

Self study : 5h 10m

GRADING SYSTEM

The final mark of the course is obtained as follows:

First exam (oral presentation) (20%) + Second exam (test) (40%) + Coursework (report and oral presentation) (40%).

Exams may include theoretical or applied questions.

Students who have failed the ordinary evaluation and who have regularly taken the evaluation tests will have the option of taking a re-evaluation test in the period set in the academic calendar. Students who have already passed the test or students qualified as not presented or who have not delivered all the coursework and reports may not take the reassessment test.

The reassessment will consist of a single exam that covers all the content of the course. The maximum grade in case of taking the reassessment exam will be five (5.00). If the student who appears in the re-evaluation exam does not pass, the highest grade between the result of the ordinary evaluation and that of the re-evaluation will be kept.

The non-attendance of a student to the re-evaluation test, held in the set period, may not lead to another test at a later date.

Extraordinary evaluations will be carried out for those students who, due to accredited force majeure, have not been able to take any of the continuous evaluation tests. These tests must be authorized by the head of studies, and will be carried out within the corresponding period.

EXAMINATION RULES.

To pass the course the student must have completed the course assignment and reach, globally, a score higher than or equal to 5/10.

Failure to perform the continuous assessment activity in the scheduled period will result in a mark of zero in that activity.

The tests will be carried out individually, with multiple choice questions that can be theoretical or problem-type questions. The exams can include short questions to be developed by the students and exercises to be solved.

BIBLIOGRAPHY

Basic:

- World Commission on Environment and Development. Our common future. Oxford: Oxford University, 1987. ISBN 019282080X.
- European Commission - Joint Research Centre. ILCD handbook: general guide for life cycle assessment: detailed guidance [on line]. First edition. Luxembourg: Publications Office of the European Union, 2010 [Consultation: 18/06/2024]. Available on: <https://library.wur.nl/WebQuery/titel/1961020>. ISBN 9789279190926.
- ISO . ISO 14040 - Environmental management - Life cycle assessment . 2006.
- ISO. ISO 14044 - Environmental management - Life cycle assessment - Requirements and guidelines. 2006.
- UNEP. Guidelines for social life cycle assessment of products and organizations [on line]. Paris: Economy Division. United Nations Environment Programme, 2020 [Consultation: 18/06/2024]. Available on: <https://www.lifecycleinitiative.org/wp-content/uploads/2021/01/Guidelines-for-Social-Life-Cycle-Assessment-of-Products-and-Organizations-2020-22.1.21sml.pdf>.
- Hauschild, M.Z.; Rosenbaum, R.K.; Olsen, S.I. Life cycle assessment: theory and practice [on line]. Springer International Publishing, 2018 [Consultation: 18/06/2024]. Available on: <https://link-springer-com.recursos.biblioteca.upc.edu/book/10.1007/978-3-319-56475-3>. ISBN 9783319564753.

Complementary:

- ISO. ISO 14046:2014. Environmental management Water footprint Principles, requirements and guidelines. 2014.
- Goedkoop, M.; Oele, M.; Leijting, J.; Ponsioen, T.; Meijer, E. Introduction to LCA with SimaPro [on line]. Report version 5.2. Amersfoort, Holanda: Pré Consultants, 2016 [Consultation: 21/06/2024]. Available on: <https://pre-sustainability.com/files/2014/05/SimaPro8IntroductionToLCA.pdf>.
- ISO. ISO/TS 14067:2013. Greenhouse gases Carbon footprint of products Requirements and guidelines for quantification and communication. 2013.