SYLLABUS

Name: Life Cycle Assessment
Name in Polish: Ocena cyklu życia
Name in English: Life Cycle Assessment

Information on course:

Course offered by department:	Faculty of Organisation and Management
Course for department:	Silesian University of Technology
Study level and form:	Bachelor's degree, Full-time
Term:	summer semester 2025/2026
Coordinator of course edition:	Dr inż. Jolanta Baran

Default type of course examination report:

Credit

Language:

English

Course homepage:

https://platforma.polsl.pl/roz/

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3

Short description:

The aim of the course is to provide students with knowledge regarding methods and tools for product life cycle assessment. The topics of the lectures include the impact of products on the environment in the value chain - from acquiring raw materials needed for production, through the manufacturing and distribution process, to the use and disposal of post-consumer waste, i.e. "from cradle to grave". In practical terms, the student acquires the skills to implement simple analytical steps in the field of life cycle assessment (LCA) and carbon footprint analysis (CF). During the classes, process and life cycle modeling is also carried out in a computer program dedicated to LCA - SimaPro (Engineering Design and Life Cycle Management Laboratory).

Description:

Detailed program content:

Lecture (30h):

1. Rationales for thinking in terms of the LCT (Life Cycle Thinking).
2. The product's impact on the environment during its life cycle.
3. Product life cycle in engineering thinking and design.
4. Life cycle assessment as a method for estimating the potential impact of products on the environment (ISO 14040).
5. Life cycle impact assessment – methodology for assessing life cycle impact according to ISO 14044.
6. Principles and standards of designing sustainable products.
7. Carbon footprint of the organization - scope 1&2 and 3 according to the GHG Protocol and ISO/TR 14069.
8. Product carbon footprint according to ISO 14067.
9. Water footprint according to ISO 14046.
10. Environmental footprint in public procurements.
11. LCA analysis for the circular economy.
12. The use of LCA in taxonomy.
13. Technical documentation as a source of data for LCA.
14. Development of engineering and analytical tools to reduce the impact of processes and products on the environment.
15. Life Cycle Management methodology and tools.

Laboratory (30h):

1. Introduction to SimaPro.
2. Determination of the functional unit (declared unit) and reference flows, product system boundaries and other parameters for assessing the impact of the selected product's life cycle on the environment.
3. Format for documenting product life cycle data (ISO/TS 14048).
4. The process of preparation for data collection, data collection and their assignment to a unit process and a functional unit.

5. Using databases in SimaPro, including ecoinvent.
6. Modeling of unit processes in SimaPro.
7. Life cycle modeling in SimaPro.
8. LCIA analysis in SimaPro, taking into account the endpoint and midpoint impact categories.
9. Classification, characterization, normalization, weighting in SimaPro.
10. Identification of significant issues.
11. Interpretation of LCA results for ecodesign purposes.
12. Sensitivity analysis and comparative studies.
13. Critical review and final report.
14. Environmental product declaration.
15. Product life cycle analysis in business communication.

Number of hours of classes with direct participation of academic teachers or other people conducting classes and students.
Lecture: 30
Laboratory: 30

Number of hours devoted to the student's own work: 60 (including consultations, studying literature and standards, preparing to pass a colloquium, performing tasks as part of laboratory classes).

Bibliography:

1. Environmental life cycle assessment of goods and services: an input-output approach / Chris T. Hendrickson, Lester B. Lave, H. Scott Matthews; with Arpad Horvath [et al.]. - Washington : Resources for the Future, cop. 2006.
2. Life cycle assessment handbook: a quide for environmentally sustainable products / ed. by Mary Ann Curran. - Hoboken: Wiley; Beverly, MA: Scrivener Publishing, cop. 2012.
3. Life cycle assessment in industry and business: adoption patterns, applications and implications / Paolo Frankl, Frieder Rubik (ed.); with contributions by Matteo Bartolomeo [et al.]. - Berlin: Springer, 2000.
4. EN ISO 14040:2006 Environmental management – Life cycle assessment – Principles and framework, European Committee for Standardization, Brussels.
5. EN ISO 14044:2006 Environmental management – Life cycle assessment – Requirements and guidelines, European Committee for Standardization, Brussels.
6. ISO/TS 14048, Environmental management — Life cycle assessment — Data documentation format.
7. ISO/TR Environmental management — Integrating environmental aspects into product design and development.
8. ISO 14067:2018 Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification.
9. ISO/TR 14069:2013 Greenhouse gases - Quantification and reporting of greenhouse gas emissions for organizations - Guidance for the application of ISO 14064-1.
10. World Resources Institute and World Business Council for Sustainable Development (2004). Greenhouse Gas Protocol. A Corporate Accounting and Reporting Standard REVISED EDITION.

Learning outcomes:

KNOWLEDGE: knows and understands

K1A _W3
Basic engineering processes and technologies in the life cycle of technical equipment, objects and systems and ways of solving typical engineering tasks, particularly in relation to the organization of production processes and production management.

K1A _W6
Basic principles and objectives of sustainable development and their importance in the product life cycle.

SKILLS: is able to

K1A _U1
Identify, formulate and solve complex and unusual engineering problems related to the field of management and production engineering by applying the principles of engineering, science and mathematics, as well as perform tasks under conditions that are not fully predictable.

K1A _U3
Plan and conduct experiments, including measurements and computer simulations, visualize data and interpret the obtained results and draw conclusions.

K1A _U4
When identifying and formulating specifications for engineering tasks and solving them:
-select and use analytical, simulation and experimental methods, including computer-aided methods,
-recognize their system and non-technical aspects, including ethical aspects
-make preliminary economic assessment of the proposed solutions and engineering actions taken,
-analyze technology transfer and innovation.

K1A _U10
Integrate and apply interdisciplinary knowledge from engineering and technical sciences incorporating principles and objectives of sustainable development to product life cycle management.

SOCIAL COMPETENCE: is ready fof

K1A _K3
Responsible performance of professional roles, compliance with the rules of professional ethics and requiring it from others, care for the achievements and traditions of the profession; is aware of the importance and understands non-technical aspects and effects of engineering activities.

Assessment methods and assessment criteria:

Lectures are passed on the basis of a written test, which consists of closed questions.
The condition for receiving a positive grade from the lecture is to achieve at least 60% correct answers.
Two deadlines for corrections in writing are assumed.

The laboratory classes are passed by completing five analytical tasks using SimaPro software, excel and word. Tasks should be completed in two-person sections. Written works (reports) and oral answers are assessed.

The final grade for the course is the value of the arithmetic mean of the grade for the lecture and the grade for the laboratory classes.

Practical placement:

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