GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2025-2026

Concepts for Sustainable Systems Engineering (I003061)

Course size *(nominal values; actual values may depend on programme)*

Credits 3.0 **Study time 90 h**

Course offerings in academic year 2025-2026

A (semester 1)	English	Gent

Lecturers in academic year 2025-2026

Huysveld, Sophie	LA24	lecturer-in-charge
Cadena Martinez, Erasmo	LA24	co-lecturer
Nachtergaele, Pieter	LA24	co-lecturer

Offered in the following programmes in 2025-2026	crdts	offering
Bachelor of Science in Bioscience Engineering	3	A
Bachelor of Science in Environmental Technology	3	A
Master of Science in Environmental Science and Technology	3	A
Exchange Programme in Bioscience Engineering: Chemistry and Bioprocess Technology (master's level)	3	A
Exchange Programme in Bioscience Engineering: Environmental Technology (master's level)	3	A
Exchange Programme in Bioscience Engineering: Food Science and Nutrition (master's level)	3	A

Teaching languages

English

Keywords

sustainability, circular economy, process integration, product design, life cycle thinking, life cycle sustainability assessment

Position of the course

This course focuses on the sustainability (assessment) of technological operations (human activities) and how to make them more sustainable from an environmental perspective in the first place, but also attention is paid to economic and social aspects. On the one hand, relevant concepts are covered in a theoretical way. On the other hand, process integration is taught how to conduct it in a practical way.

Contents

- Clean technology
- Ecosystem services
- Circular economy and related concepts (e.g. industrial ecology, industrial symbiosis)
- Life cycle sustainability (including Life Cycle Assessment (LCA), Life Cycle Costing (LCC), social LCA, etc.) and challenges
- Sustainbility in industrial production (process level), including exercises on heat integration

Initial competences

Students are expected to have a scientific background at a university level (physics, chemistry, life sciences) and basic engineering skills (such as unit conversions, mass and energy balances).

Final competences

1 Explain how resource consumption and emissions from technological operations affect environmental sustainability.

2 Have knowledge of the nowadays (global) relevant environmental issues.
3 Explain the concepts of clean technology, industrial ecology, circular economy, life cycle thinking and process integration.
4 Apply life cycle thinking when analyzing the sustainability of technological operations.
5 Explain the challenges of prospective sustainability assessment of technological operations.
6 Distinguish environmental, economic and social effects of technological operations.
7 Explain approaches that improve the sustainability of technological operations at the process level, the product design level, as well as the company/management level.
8 Apply mass and energy integration for process optimization.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Group work, Seminar, Lecture, Peer teaching

Extra information on the teaching methods

Lectures: theory. Some lectures can be supplemented with online video material.
Seminar - coached exercises: 1 exercise session to solve exercises on process integration.
Groupwork: one lecture to explain the assignment and one feedback moment with lecturer.
Peer teaching: presentation assignment to other students in week 13.

Study material

Type: Slides

Name: Slides
Indicative price: Free or paid by faculty
Optional: no
Language : English
Available on Ufora : Yes
Online Available : Yes

References

Background material will be made available through the student platform (Ufora).

Course content-related study coaching

Contact hours with the lecturers for individual guidance

Assessment moments

end-of-term and continuous assessment

Examination methods in case of periodic assessment during the first examination period

Written assessment with open-ended questions

Examination methods in case of periodic assessment during the second examination period

Written assessment with open-ended questions

Examination methods in case of permanent assessment

Participation, Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible in modified form

Extra information on the examination methods

Periodic evaluation:
- written exam
- study material: theory lectures + exercise session

Non-periodic evaluation:
- Presence/participation at 1 lecture with assignment explanation
- Report and presentation of assignment (groupwork): The assignment is to

critically evaluate the sustainability and viability of an emerging technology based on a literature review of the technology and a relevant sustainability assessment method (e.g. Life Cycle Assessment). Evaluation is based on quantitative data extracted from the literature and justified assumptions. Students can start the assignment after the lecture in which it is explained (around week 2). Deadline for submission of the assignment (around week 11 or week 12) and the date of the presentation (week 13) will be provided through the student platform.

- Presence/participation at assignment presentations of other students

Calculation of the examination mark

Periodic evaluation (written exam): 65% or 13/20
Non-periodic evaluation (assignment, and participation at 1 lecture with task explanation and participation at the assignment presentations): 35% or 7/20
Students who eschew one or more parts of the evaluation may be failed by the examiner. Final scores of 10/20 and above may be reduced to the highest tolerable mark (7/20).
Peer assessment will be performed for the groupwork, hence the final mark per student belonging to the same group may differ. The deadlines for the assignment must be respected. If not, the final mark may be reduced. If the student obtains a total mark lower than 10/20, the mark obtained for the non-periodic evaluation during the first examination period can be transferred to the second examination period only if the student did not fail, i.e. he/she did not have a mark lower than 3.5 /7.