GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2020-2021

Clean Technology (I002700)

Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

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

Credits 5.0 **Study time** 150 h **Contact hrs** 50.0 h

Course offerings and teaching methods in academic year 2021-2022

A (semester 1)	English	Gent	seminar: coached exercises	5.0 h
			seminar: practical PC room classes	5.0 h
			microteaching	3.75 h
			group work	1.25 h
			lecture	35.0 h

Lecturers in academic year 2021-2022

Huysveld, Sophie	LA24	lecturer-in-charge

Offered in the following programmes in 2021-2022	**crdts**	**offering**
Bachelor of Science in Environmental Technology	5	A
Master of Science in Electromechanical Engineering (main subject Control Engineering and Automation)	5	A
Master of Science in Business Engineering (main subject Data Analytics)	5	A
Master of Science in Electromechanical Engineering (main subject Electrical Power Engineering)	5	A
Master of Science in Electromechanical Engineering (main subject Maritime Engineering)	5	A
Master of Science in Electromechanical Engineering (main subject Mechanical Construction)	5	A
Master of Science in Electromechanical Engineering (main subject Mechanical Energy Engineering)	5	A
Master of Science in Business Engineering (main subject Operations Management)	5	A
Master of Science in Chemical Engineering	5	A
Master of Science in Sustainable Materials Engineering	5	A
Master of Science in Chemical Engineering	5	A
Master of Science in Bioscience Engineering: Chemistry and Bioprocess Technology	5	A
International Master of Science in Sustainable and Innovative Natural Resource Management	5	A
Exchange Programme in Bioscience Engineering: Chemistry and Bioprocess Technology (master's level)	5	A
Exchange Programme in Bioscience Engineering: Environmental Technology (master's level)	5	A
Exchange Programme in Bioscience Engineering: Food Science and Nutrition (master's level)	5	A

Teaching languages

English

Keywords

Clean technology, sustainable technology, industrial ecology, green chemistry, process integration, environmental performance tools, sustainability assessment, life cycle assessment, exergy, exergy analysis

Position of the course

This course focuses on the sustainability (assessment) of technological operations and how to

make them more sustainable. Attention is paid in how far the choice of resources, process efficiency and avoidance of waste streams all contribute to sustainable technology. Concepts of clean technology, industrial ecology and green chemistry/chemical engineering are discussed. Pollution prevention at the unit operations is covered, as well as process integration, which is taught how to apply it. Management approaches that improve sustainability, more specifically, design for sustainability (D4S) and ecomanagement and audit scheme (EMAS) are explained. Regarding assessment methods, environmental performance tools at tier 1 and tier 2 levels are covered. The widely used method life cycle assessment is well elaborated on and taught how to conduct it. Additionally, the concept of exergy is explained and exergy analysis is applied.

Contents

Chapter 1: Technology and Sustainability
Chapter 2: The Natural Environment: Resource Base and Sink for Emissions
Chapter 3: Changing Technology through New Concepts
Chapter 4: Changing Technology at the Process
Chapter 5: Changing Technology through Proper Management
Chapter 6: Assessing Technology through Input/Output Analysis
Chapter 7: Assessing Technology through Life Cycle Assessment
Chapter 8: Assessing Technology through Exergy Analysis

Initial competences

Natural sciences at the university level

Final competences

1 Understand how resource consumption and selection, process efficiency and emission patterns affect the contribution of technology to environmental sustainability. Also the importance of technology within industrial society has to be understood.
2 Have a knowledge of the nowadays (global) relevant environmental issues.
3 Comprehend the concepts: industrial ecology, green chemistry (and its principles), green (chemical) engineering and clean technology.
4 Comprehend and being able to apply approaches for energy integration and mass integration (source-sink mapping and mass exchange network synthesis).
5 Comprehend management approaches that improve sustainability, more specifically: design for sustainability (D4S) and, ecomanagement and audit scheme (EMAS).
6 Grasp tier 1 and tier 2 environmental performance tools and release quantification methods.
7 Grasp the concept of life cycle assessment and all its aspects.
8 Being able to conduct a life cycle assessment to a certain extent (this with the aid of software).
9 Grasp the concept of exergy and exergy analysis. Being able to quantify the exergy amount of a flow to the extent defined by presented data and formulae.

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, lecture, microteaching, seminar: coached exercises, seminar: practical PC room classes

Extra information on the teaching methods

Lectures: theory and guestspeakers from industry. Dates will be announced in the first theory lecture and through the student platform.
Seminar - coached exercises: 2 exercise sessions to solve exercises on process integration and exergy in group. Dates will be announced in the first theory lecture and through the student platform.
Seminar - practical PC room classes: 2 coached PC sessions to prepare for the LCA assignment (groupwork). Dates will be announced in the first theory lecture and through the student platform.
Groupwork: feedback moment with lecturers for the LCA assignment.
Microteaching: presentation assignment to other students in week 13.

Learning materials and price

A syllabus is available and can be purchased from the student organization of the faculty (www.boerekot.be and vlk.cursus@gmail.com). Slides of the lectures will be uploaded (partially) to the student platform.

References

Anastas P.T. and Warner J.C. (1998) Green Chemistry: Theory and Practice. Oxford University Press, New York, 135p
Graedel T.E. and Allenby B.R. (1996) Design for Environment. Prentice Hall, New Jersey, 175p
Johansson A. (1992) Clean technology. Lewis Publishers, Boca Raton, 196p
Lowe E.A., Warren J.L. and Moran S.R. (1997) Discovering industrial ecology - An executive briefing and sourcebook. Battelle Press, Columbus, 191p
Kotas T.J., The exergy method of thermal plant analysis, Butterwoods, London, 1985, 296p
Moran M.J., Availability analysis, a guide to efficient energy use, corrected edition, The American Society of Mechanical Engineers, New York, 1989, 260p

Course content-related study coaching

Contact hours with the lecturers for individual guidance.

Evaluation methods

end-of-term evaluation and continuous assessment

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

Written examination with open questions, open book examination

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

Written examination with open questions, open book examination

Examination methods in case of permanent evaluation

Participation, assignment

Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible in modified form

Extra information on the examination methods

Periodic evaluation:

- written open book exam
- study material: theory lectures + guest lectures + exercise sessions

Non-periodic evaluation:

- Presence/participation at 2 exercise sessions, 2 coached PC sessions and 2 guest lectures
- Report and presentation of assignment (groupwork): The assignment is to perform an LCA (compare 2 product alternatives or evaluate the ecodesign of a product) with the aid of software. Students can start the assignment after the first coached PC session to prepare for the assignment (around week 4). Deadline for submission of the assignment (around week 11) and the date of the presentation (week 13) will be provided through the student platform.
- Presence/participation at assignment presentations of other students (a half day)

Calculation of the examination mark

Periodic evaluation (written exam): 65% or 13/20
Non-periodic evaluation (assignment, and participation at 2 exercise sessions, participation at 2 coached PC sessions, participation at 2 guest lectures and participation at the task 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 failing mark (9/20).
If there is clearly a different input from the different students in the assignment, then 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.