GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2018-2019

Clean Technology (I000834)

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

Credits 5.0	Study time 135 h	Contact hrs 60.0 h

Course offerings and teaching methods in academic year 2018-2019

A (semester 1)	English	microteaching	3.75 h
		lecture	43.75 h
		seminar: coached exercises	6.25 h
		group work	1.25 h
		seminar: practical PC room classes	5.0 h

Lecturers in academic year 2018-2019

Dewulf, Jo	LA24	lecturer-in-charge
Huysveld, Sophie	TW11	co-lecturer

Offered in the following programmes in 2018-2019	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 Business Engineering (main subject Finance)	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
Master of Science in Bioscience Engineering: Environmental 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

Teaching languages

English

Keywords

Clean technology, sustainable technology, industrial ecology, green chemistry, sustainability assessment, life cycle assessment/analysis, exergy

Position of the course

This course focuses on sustainability (assessment) of technological operations and how to make them more sustainable. Attention is paid in how far choice of resources, process efficiency and avoidance of waste streams all contribute to clean technology. Here, concepts of sustainable technology, industrial ecology, green chemistry, are discussed. The tool life cycle assessment is well elaborated on. Next, specific (semi) quantitative approaches such as life cycle analysis, design for environment, pinch analysis, input/output analysis and exergy analysis will be studied and taught how to apply them.

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 and engineering in general

Final competences

1 Understanding 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 & clean technology
4 Comprehend and being able to apply approaches for energy integration & 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

Learning materials and price

A syllabus is available and can be purchased from the student organization of the faculty (members €11.20 and non-members €13).

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

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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

Theory lectures and exercises*:* dates will be announced in the first theory lecture and through Minerva
Guest speaker lectures: dates will be announced through Minerva
Group work: dates of the coached PC exercises to prepare for the task will be announced in the first theory lecture and through Minerva. Deadline for submission of the report and the date of the presentation will be provided through Minerva.
Written exam (periodic evaluation):

- theory lectures + guest speaker lectures + exercises
- written (open book) examination

Group work (non-periodic evaluation/permanent evaluation):

- Report and presentation of group work
- Presence/participation at presentations

Calculation of the examination mark

Written exam (periodic evaluation): 13/20
Group work (non-periodic evaluation/permanent evaluation): 7/20
Non-participation in the group work gives rise to a maximum total score of 9/20, regardless of the score obtained for the written periodic exam. If there is clearly a different input from the different group members, then the final score per student belonging to the same group may differ. The deadlines for the group work must be respected. If not, the final score may be reduced. If the student obtains a total score lower than 10/20, the score obtained for the group work during the first examination period can be transferred to the second examination period only if the student did not fail for the group work, i.e. did not have a score lower than 4/7.