



Universiteit Leiden



Faculty of Science, Leiden University

and

**Faculty of Technology, Policy and Management,
Delft University of Technology**

Implementation Regulations

31 August 2020 till 31 August 2021

Masters' Programme Industrial Ecology

**Corresponding to the Course and Examination Regulations
of the Master's Programme Industrial Ecology**

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Section 1 – General and admission to the Programme

Article 1.1 – Semesters and start of the study

The academic year is divided into two semesters.

Article 1.2 - Confirmation of admission

1. The Faculty Board provides confirmation of admission if the student meets the entry requirements specified in Articles 1.3, 1.4 and 1.5, as long as the maximum number of students that the Executive Board has determined may be enrolled in the programme has not been exceeded. If admission is on the basis of Article 1.3, the proof of registration is also confirmation of admission.
2. Confirmation of admission must be applied for according to the rules set out in the Regulations for Admission to Master's Programmes.¹

Article 1.3 - Admission to the programme

1. Pursuant to Article 7.30b (1) of the Act the following candidates may be admitted to the programme and one of its specialisations: holders of a bachelor's degree in any of the Natural Sciences, Engineering Sciences, or Social Sciences from a research university in the Netherlands, or from a foreign research university of similar level.
2. The Board of Admissions may, on request, admit persons to the programme who do not meet the requirements specified in 1.3.1, but who can demonstrate to the satisfaction of the Board of Admissions that they possess the same level of knowledge, understanding and skills as holders of a degree specified 1.3.1, possibly under further conditions, without prejudice to the conditions specified in 1.5.1.
3. Article 1.3.2 may, amongst others, apply to holders of a degree from a University of Applied Sciences (hoger beroepsopleiding, hbo) in the Netherlands in Natural Sciences or Engineering Sciences, or from a foreign University of Applied Sciences of similar level and length of studies. The hbo diploma has to be obtained with a grade point average of at least 7.5.

Article 1.4 - Admission to Erasmus Mundus programme on circular economy (CIRCLE)

Applicants for the Erasmus Mundus programme on circular economy (CIRCLE) are reviewed, evaluated and selected by the CIRCLE admission committee, according to the CIRCLE selection criteria.

Article 1.5 - Dutch and English languages²

1. As further clarification of Article 2.5 in this master's Course and Examination Regulations concerning command of the language of instruction, a student who wishes to be admitted to an English-taught master's programme must have one of the following diplomas or must meet the criteria of:
 - An International Baccalaureate diploma (with English A);
 - A diploma of secondary or higher education completed in the US, the United Kingdom, Ireland, New Zealand, Australia or Canada (with the exception of French-taught education in Canada);
 - A diploma of an English-taught university degree programme completed at a Dutch research university;

¹ <https://www.organisatiegids.universiteitleiden.nl/en/regulations/general/regulations-for-admission-to-master-programmes>

² Letter of the Minister of Education, Culture and Science of 11 July 2018, decision on costs of standardised tests (costs of standardised tests, including language tests, are to be paid by the study programme from the academic year 2019-2020). This applies for all students. If possible, the Minister will make a decision on a different procedure for students with a diploma from outside the Netherlands.

- A Dutch pre-university education (vwo) diploma.
- 2. If a student who wishes to be admitted does not meet the requirements in 1.4.1., at least one of the following language requirements can be set:
 - IELTS: minimum 6.5 overall score, with a minimum of 6.0 for each of the components Listening, Reading, Writing and Speaking.
 - TOEFL: internet based 90 (minimum 20 component score).
 - Cambridge C2 Proficiency (CPE) or C1 Advanced (CAE): a score of at least 180 (minimum 169 component score).

Article 1.6 - Qualitative admission requirements

1. In addition to the requirements specified in 1.3, 1.4 and 1.5, the following qualitative admission requirements apply for the programme pursuant to Article 7.30b (2) of the Act:
 - a) Demonstrable affinity with multi- or interdisciplinary education and/or research.
 - b) Demonstrable interest in the field of sustainability.
 - c) Having passed one or multiple courses that included a minimum of 6 ECTS of mathematics and/or statistics.
2. Applicants as referred to in 1.3 need to provide the Board of Admissions with:
 - a. copies of diploma(s) and transcript(s)
 - b. a motivation letter which, in relation to the qualitative admission requirements specified in 1.6.1, elaborates on relevant course modules, summer courses, internships, or other relevant experiences at a sufficient academic level.
3. The admission process may include an interview with the Board of Admissions, should this be necessary to clarify whether the applicant has the same level of knowledge, understanding and skills as holders of a degree specified in 1.3.1 and 1.3.3 and meets the qualitative requirements specified in 1.6.1.
4. The deadline for fulfilment of the requirements mentioned in 1.3, 1.5 and 1.6.1 is before the start of the academic year in which the student starts the programme. However, applicants need to elaborate on the qualitative admission requirements in their motivation letter when applying for the programme.

Article 1.7 - Maximum capacity

Not applicable.

Article 1.8 Deficiencies

1. Holders of a bachelor's degree as referred to in 1.3.1. and 1.3.2 with x (may vary from 1 to 15) ECTS of deficiencies, may be admitted to the programme, as long as it may reasonably be expected that they will meet the entry requirements within a reasonable period of time.
2. Students who still have deficiencies referred to in 1.8.1 when admitted to the programme may participate in the programme but may not sit any final examinations or examinations that the Faculty Board has specified in its decision to grant admission.
3. For the admission referred to in 1.8.1. the Board of Admissions assembles a catch-up programme with examination opportunities.
4. If a student is admitted to the programme on the basis of 1.8.1 and must sit examinations to meet the entry requirements, these are not considered part of the curriculum of the Master's programme.

Article 1.9 Bridging programmes (Pre-master's)

Not applicable.

Article 1.10 – Special tracks

The master's programme does not offer special tracks.

Section 2 – Description of the Master’s Programme

For students who have started the Master’s programme before September 2020, the articles 2.1-2.6 and the transitional arrangements described in article 2.13 apply.

Article 2.1 – Learning outcomes

The Industrial Ecology programme is an interdisciplinary programme, which focuses on the analysis of sustainability problems and the design and implementation of solutions for these problems; all from a socio-technical system perspective. The aim of the programme is to educate students to become researchers or practitioners who can contribute to the development of solutions for persistent sustainability problems, such as related to resource depletion and climate change. The programme has been designed to transfer knowledge from natural science, engineering and social science, and enable students to integrate that knowledge to analyse sustainability problems and design science based solutions.

Graduates from the master’s programme Industrial Ecology will:

1. have a thorough knowledge of the field of Industrial Ecology and its object society’s metabolism and be able to reproduce and discuss its main theories, concepts, methods;
2. be able to perform scientific research in the field of Industrial Ecology;
3. be capable of applying and improving the methods, techniques and tools of Industrial Ecology in order to design science based solutions for sustainability problems;
4. have the ability to analyse sustainability problems, to design solutions and to develop implementation plans for those solutions, all from an Industrial Ecology systems perspective;
5. have the expertise to be able to contribute to the societal sustainability debate from an Industrial Ecology perspective and be able to identify and manage trade-offs and synergies between solutions.

Article 2.2 - Overview of the two-year curriculum

1. Core Modules (54 EC)
2. Interdisciplinary Project Groups (12 EC)
3. Specialisation Modules (18 EC)
4. Thesis Preparation Module (6 EC)
5. Thesis Research Project (30 EC)

Course code	Course	Level	EC
Core Modules (see article 2.3)		500	54
4413GEIIE	General Introduction to Industrial Ecology	500	6
4413FMDA6	Fundamentals of Modelling and Data Analysis	500	6
4413ANMT6	Analytical Methodologies and Tools	500	6
4413CLOSC	Closed Loop Supply Chains	500	6
4413RENES	Renewable Energy Systems	500	6
4413SYSEA	System Earth	500	6
4413DoSTS	Design of Sustainable Technological Systems	500	6
4413SUISC	Sustainable Innovation and Social Change	500	6
4413UEINF	Urban Environments and Infrastructures	500	6
		600	12

Interdisciplinary Project Groups (see article 2.4)			
4413INTPG	Interdisciplinary Project Groups	600	12
Specialisation Modules (see article 2.5)		Master	18
Thesis Research Project (see article 2.6)		600	36
4413TRP30	Thesis Preparation Module	600	6
4413GRPMD	Thesis Research Project	600	30
Total of the two-year curriculum Industrial Ecology			120
Specialisation Modules provided by the Industrial Ecology Master's programme			
4413LCA9E	LCA Practice & Reporting	600	9
4413EIOA5	Environmental Input-Output Analysis	500	5
4413MFA20	Material Flow Analysis	600	5
4413GIS20	GIS: Spatial analysis in urban regions	500	5
4413CIRC6	Circular Economy	500	5
4413IECS2	Industrial Ecology Capita Selecta Module	500	2
4413IECS3	Industrial Ecology Capita Selecta Module	500	3
4413IECS4	Industrial Ecology Capita Selecta Module	500	4
4413IECS5	Industrial Ecology Capita Selecta Module	500	5
4413IECS6	Industrial Ecology Capita Selecta Module	500	6

Article 2.3 – Core modules (54 EC)

These form the central part of the programme and are compulsory for every student.

Article 2.4 – Interdisciplinary Project Groups (12 EC)

In the second year, students join project groups in which they are trained to solve real-life Industrial Ecology problems, by integrating the knowledge and insights they have acquired from studying different disciplines. Students can only participate in the Interdisciplinary Project Groups if they have finished at least 48 EC of the core modules.

Article 2.5 – Specialisation Modules (18 EC)

1. Of the 18 EC, a minimum of 12 EC of the Specialisation Modules have to be relevant for the field of Industrial Ecology, preferably also to the topic of the Thesis Research Project, and at master education level, i.e. for Leiden University with a level 400 or higher, for Delft University of Technology or other universities the course has to be from a master's programme or comparable to an MSc level at a Dutch research university.
2. A document with pre-approved Specialisation Modules, relevant for the field of Industrial Ecology, can be found on Brightspace. Within the 12 EC Industrial Ecology relevant Specialisation Modules, from this document only one course from the cluster Entrepreneurship, one course from the cluster Organisation and Management and one course from the cluster Serious Games can be chosen.
3. If a student wants to take a module that is not in the document with pre-approved Specialisation Modules mentioned in 2.5.2. and wants to use it for the 12 EC of Specialisation Modules relevant for the field of Industrial Ecology (as described in 2.5.1), approval by the Board of Examiners (BoE) is needed. A request for a Specialisation Module should be submitted by the student to the BoE via BoE-IE@cml.leidenuniv.nl. This request should be accompanied by a letter of motivation, course description and a student's Individual Study Programme (ISP).
4. For the remaining 6 EC of the 18 EC, the only requirement is that the course or courses are at least on master education level and are not language course(s) (even if a language course is offered on master education level). In addition, the content of the course(s) should not overlap with other courses on a student's Individual Study Programme (ISP).

Admission criteria for Specialisation Modules offered by other programmes can be obtained from those programmes i.e. the online prospectus of the module.

Article 2.6 – Thesis Preparation Module and Thesis Research Project (36 EC)

1. The graduation is composed of two courses, the Thesis Preparation Module and Thesis Research Project. Students have to select, depending on their interest and background, a research topic in deliberation with an examiner. Students have to work independently on a research project. As preparation to the research topic, the involved supervisors may ask the student to successfully finish specific Specialisation courses. This has to be discussed with the student before the Thesis Research Project starts.
2. Students can only start the Thesis Research Project if:
 - At least 48 EC of the core modules is sufficiently completed.
 - The module 4413GRPMD Thesis Preparation Module is sufficiently completed.
 - The Individual Study Programme (ISP) satisfies the final terms as described in the Course and Examination Regulations (CER) and Implementation Regulations.
 - The Thesis Kick-Off Form is completed and handed in to the programme coordinators.

For students who have started the Master's programme per September 2020, articles 2.7 – 2.12 apply:

Article 2.7 – Learning outcomes

Knowledge, understanding, integration and application

The student has:

1. thorough understanding of society's metabolism, its role in sustainability issues and its drivers and impacts;
2. thorough knowledge of the most important approaches, hereby defined as theories, methods and tools, used in Industrial Ecology research;
3. in-depth knowledge of at least one approach used for analysing physical processes and one approach for analysing social processes, used in Industrial Ecology research.

The student is able to:

4. apply systems thinking in analysing society's metabolism and in evaluating and designing solutions to sustainability problems;
5. systematically combine and integrate knowledge, methods and tools from various disciplines relevant to Industrial Ecology;
6. formulate relevant research questions and choose the appropriate methods to answer these questions;
7. apply and critically evaluate at least one approach for analysing physical processes and one approach for analysing social processes, used in Industrial Ecology research;
8. contribute to the further development and/or validation of theories, methods or tools in Industrial Ecology research.

Skills

The student is able to:

9. constructively work and actively collaborate in multidisciplinary and international teams;
10. gather, use and integrate data from multiple sources;
11. independently plan, conduct and evaluate in-depth research, within an interdisciplinary context,
12. convincingly communicate results to specialist and non-specialist audiences, both verbally and in writing, with due attention to uncertainties;
13. design and plan her/his own learning processes through continuous reflection on personal knowledge, skills, attitudes and performance;
14. reflect on the ethical aspects of her/his research and to incorporate these reflections in setting up research and developing recommendations and/or sustainability solutions.

Article 2.8 - Overview of the two-year curriculum

1. Core courses (30 EC)
2. Industrial Ecology Project 1 (10 EC)
3. Industrial Ecology Project 2 (10 EC)
4. Specialisation courses (35 EC, including 10 EC restricted)
5. Thesis Preparation (5 EC)
6. Thesis Research Project (30 EC)

Course code	Course	Level	EC
Core courses (see article 2.9)			30
4413SOCMB	Society's Metabolism	500	5
4413EASYS	Earth System	500	5
4413MAPP5	Methods: Analysing Physical Processes	500	5
4413SDFIE	System Design for Industrial Ecology	500	5
4413TRIG5	Transitions, Innovation and Governance	500	5
4413MASP5	Methods: Analysing Social Processes	500	5
Industrial Ecology Projects (see article 2.10)			20
4413IEPR1	Industrial Ecology Project 1	500	10
	Industrial Ecology Project 2	600	10
Specialisation courses (see article 2.11)			500/600/master
Thesis Research Project (see article 2.12)			35
	Thesis Preparation Course	600	5
	Thesis Research Project	600	30
Total of the two-year curriculum Industrial Ecology			120
Specialisation courses provided by the Industrial Ecology Master's programme			
4413LCA9E	LCA Practice & Reporting	600	9
4413EIOA5	Environmental Input-Output Analysis	500	5
4413MFA20	Material Flow Analysis	600	5
4413GIS20	GIS: Spatial analysis in urban regions	500	5
4413CIRC6	Circular Economy	500	5
4413IECS2	Industrial Ecology Capita Selecta Module	500	2
4413IECS3	Industrial Ecology Capita Selecta Module	500	3
4413IECS4	Industrial Ecology Capita Selecta Module	500	4
4413IECS5	Industrial Ecology Capita Selecta Module	500	5
4413IECS6	Industrial Ecology Capita Selecta Module	500	6

Article 2.9 – Core courses (30 EC)

The core courses form the central part of the programme and are compulsory for every student.

Article 2.10 – Industrial Ecology Projects (10 + 10 EC)

In the first and second year, students join interdisciplinary project groups and are trained to solve interdisciplinary Industrial Ecology problems, by integrating knowledge and insights acquired from the core courses. Students can only participate in the second Industrial Ecology Project if they have finished at least 25 EC of the core courses.

Article 2.11 – Specialisation courses (35 EC)

1. 30 EC of the 35 EC meant for specialisation courses, should be used to complete courses that are relevant for the field of Industrial Ecology, preferably also to the topic of the Thesis Research Project, and at master education level, i.e. for Leiden University with a level 500 or higher, for Delft University of Technology or other universities the course has to be from a master's programme or comparable to a MSc level at a Dutch research university.
2. A document with pre-approved specialisation courses, relevant for the field of Industrial Ecology, can be found on Brightspace. When choosing Industrial Ecology relevant specialisation courses from this list, only one course from the cluster Entrepreneurship, one course from the cluster Organisation and Management and one course from the cluster Serious Games can be chosen.
3. As part of the 30 EC meant for specialisation courses relevant for the field of Industrial Ecology, students have to choose at least one course from a list of restricted electives on methods for analysing physical processes and one course from a list of restricted electives on methods for analysing social processes. These restricted electives are part of the document with pre-approved specialisation courses, mentioned in 2.11.2.
4. If a student wants to take a course that is not mentioned in the document with pre-approved courses mentioned in 2.11.2. and wants to use it for the 30 EC of specialisation courses relevant for the field of Industrial Ecology (as described in 2.11.1 or 2.11.3), approval by the Board of Examiners (BoE) is needed. A request for a specialisation course should be submitted by the student to the BoE via BoE-IE@cml.leidenuniv.nl. This request should be accompanied by a letter of motivation, course description and a student's Individual Study Programme (ISP).
5. For 5 EC of the 35 EC, the only requirement is that the course or courses are at least on master education level and are not language course(s) (even when a language course might be offered on master education level). In addition, the content of the course(s) should not overlap with other courses on a student's Individual Study Programme (ISP).

Article 2.12 – Thesis Preparation Course and Thesis Research Project (35 EC)

1. The graduation is composed of two courses, the Thesis Preparation Course and Thesis Research Project. Students have to select, depending on their interest and background, a research topic in deliberation with an examiner. Students have to work independently on a research project. As preparation to the research topic, the involved supervisors may ask the student to successfully finish specific Specialisation courses. This has to be discussed with the student before the Thesis Research Project starts.
2. Students can only start the Thesis Research Project if:
 - All the core courses (30 EC) are sufficiently completed.
 - The Thesis Preparation Course is sufficiently completed.
 - The Individual Study Programme (ISP) satisfies the final terms as described in the Course and Examination Regulations (CER) and Implementation Regulations (IR).
 - The Thesis Kick-Off Form is completed and handed in to the programme coordinators.

Article 2.12 – Composition of the Individual Study Programme

1. Each student proposes an Individual Study Programme (ISP). An ISP must satisfy the final terms as described in the Course and Examination Regulations (CER) and Implementation Regulations (IR) and is subject to the approval by the BoE.
2. Adaptations to the ISP are likewise subject to approval by the BoE.

Article 2.13 – Transitional arrangements

1. The following courses, described in article 2.2. and 2.3, will not be offered from September 2020 onwards:

Course code	Course	Level	EC
4413GEIIEY	General Introduction to Industrial Ecology	500	6
4413FMDA6Y	Fundamentals of Modelling and Data Analysis	500	6
4413ANMT6Y	Analytical Methodologies and Tools	500	6
4413CLOSCY	Closed Loop Supply Chains	500	6
4413RENESY	Renewable Energy Systems	500	6
4413SYSEAY	System Earth	500	6
4413DoSTSY	Design of Sustainable Technological Systems	500	6
4413SUISCY	Sustainable Innovation and Social Change	500	6
4413UEINFY	Urban Environments and Infrastructures	500	6

2. Following article 7.1.3 of the CER, for each of these courses, two extra resits are offered.
3. If a student does not complete one or more of the above mentioned courses with the help of the extra resits mentioned in 2.13.2, the following scheme applies:

Course code	Course	→	Course code	Alternative course
4413GEIIEY	General Introduction to Industrial Ecology	→	Not applicable	Alternative assignment(s)
4413FMDA6Y	Fundamentals of Modelling and Data Analysis	→	Not applicable	Alternative course and assignment, approved by the BoE
4413ANMT6Y	Analytical Methodologies and Tools	→	4413MAPP5	Methods: Analysing Physical Processes, plus extra assignment
4413CLOSCY	Closed Loop Supply Chains	→	4413TRIG5	Transitions, Innovation and Governance, plus extra assignment
4413RENESY	Renewable Energy Systems	→	Not applicable	Alternative course and assignment, approved by BoE
4413SYSEAY	System Earth	→	4413SOCMB	Society's Metabolism, plus extra assignment
4413DoSTSY	Design of Sustainable Technological Systems	→	4413SDFIE	System Design for Industrial Ecology, plus extra assignment
4413SUISCY	Sustainable Innovation and Social Change	→	4413TRIG5	Transitions, Innovation and Governance, plus extra assignment
4413UEINFY	Urban Environments and Infrastructures	→	4413IEPR1	Industrial Ecology Project 1 (for 6 EC instead of 10 EC)

4. If following one or more of the above mentioned alternative courses leads to fewer EC than the original 54 EC in core courses, students may be asked to fulfil an extra assignment or are allowed to complete an extra specialisation course.

Article 2.14 – Erasmus Mundus International Master's Programme on Circular Economy (CIRCLE)

Students who are admitted to the CIRCLE programme and complete their first or second year at Leiden University and the Delft University of Technology, follow the compulsory components of that year as described in Article 2.8 (year one) and Article 2.2. (year two). For the students who follow their first year at Leiden University and the Delft University of Technology, a compulsory course on circular economy is organised. The CIRCLE programme will become an official separate track within master's programme Industrial Ecology per 2021-2022.

Section 3 – Date of commencement

These regulations come into force on 31 August 2020. These regulations have been decreed by the Deans of the respective faculties together with the Course and Examination Regulations of the Master's Programme Industrial Ecology.